PUBLIC HEALTH REPORTS

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frontispiece

Mendenhall Glacier near Juneau in heavily timbered and rainy southeastern Alaska (photograph by J. Malcolm Greany, Juneau). A report on Alaska appears on pages 877–912.

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PUBLIC HEALTH SERVICE
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PHR

SYNOPSES

FREDERIKSEN, HARALD (Public Health Service): *Malaria control and population pressure in Ceylon. Public Health Reports, Vol. 75, October 1960, pp. 865–868.*

Contrary to common supposition, malaria control cannot be held responsible for the postwar population explosion in Ceylon. Mortality in the area where control programs were applied declined little more than in the nonmalarious area. Moreover, the decline in Ceylon's mortality rate has been underway with few interruptions for decades and was most precipitous the year before malaria control was widely introduced. The effect of malaria control in Ceylon has been to give hope of improved living conditions by opening to development vast areas of the island which have not been habitable for centuries because of the prevalence of malaria.

WILLIAMS, RALPH B. (Alaska Department of Health and Welfare, Juneau), and DODSON, MARIE W.: *Salmonella in Alaska. Public Health Reports, Vol. 75, October 1960, pp. 913–916.*

Results obtained in the study of 26 serotypes of some 246 *Salmonella* organisms from various locations throughout Alaska are summarized. *Salmonella typhimurium, S. typhosa, S. montevideo, S. reading,* and *S. muenchen* occurred most frequently. Geographically, the various *Salmonella* types were widely scattered. They were isolated from human beings, dogs, fur seal, seal louse, and gulls, with no foci of infection with the different types.

GALTON, MILDRED M., GORMAN, GEORGE W., and SHOTTS, EMMETT B., Jr. (Public Health Service): *A new leptospiral subserotype in the hebdomadis group. Public Health Reports, Vol. 75, October 1960, pp. 917–921.*

A new strain of leptospires belonging to the hebdomadis serogroup has been isolated and identified. This strain is represented by 20 isolates from raccoons, opossums, and a striped skunk. Cross agglutinin-absorption studies indicate that the new strain is a subserotype of *L. mini*, and the designation *L. mini georgia* is proposed. Agglutination tests with serum from 16 of 20 animals revealed antibodies against LT117, Sari, Szwajizak, or *kabura* antigen in 10 animals.

COONS, ALBERT H. (Harvard Medical School): *Immunofluorescence. The R. E. Dyer lecture. Public Health Reports, Vol. 75, October 1960, pp. 937–943.*

Fluorescent antibodies specifically mark antigenic material in tissue sections by the formation of fluorescent immune precipitates. In effect, this places the specificity of immune reactions in the hands of the histochemist or adds a new, microscopic dimension to the techniques of the diagnostic serologist. For these reasons, such reactions are of increasing importance in the study of tissue components and the movements of foreign and native macromolecules into and out of cells.

Fluorescent antibodies are also of increasingly practical value in the diagnosis of infectious disease because they can be used to identify small numbers of bacterial cells, or viral antigens in an infected host cell, and because the agent need not be viable at the time of examination. Hence, cultures of bacteria may be bypassed with a saving of time.

Success in diagnosis is dependent on the care with which the immune reagents are prepared and tested and on the controls used to establish the specificity of each reaction.

Signs and Symptoms

of trends in public health

Housing and Public Health

Milwaukee's health department is stressing deterioration of housing areas as a public health problem. "Reverse the Trend" is the title of a department pamphlet listing typical housing code violations which totaled 14,147 in 1958. The violations were discovered during 9,686 inspections conducted by the housing division of the health department.

Mental Services for Children

Only 135 hospitals in the United States separate mentally ill children from adult patients, according to a report of the National Organization for Mentally Ill Children, Inc. Existing facilities care for only 3,939 of the estimated 500,000 mentally ill children. Only 46 State mental hospitals have any provision for children, housing 1,700 of the total number needing hospitalization. Of the 3,939 children receiving some kind of services, 46 percent are patients in mental hospitals, 42 percent are in nonhospital residential facilities, and 12 percent are in day centers.

Countywide Health Service

For the first time in New Jersey's public health history, a board of chosen freeholders has created the position of county public health coordinator and appointed a licensed health officer to fill the position.

Cape May County took this action in March 1960, appointing on May 23 Joseph Pack, a graduate of the University of Denver who received a master's degree in public health from the University of North Carolina. Pack, who has been associated with the New Jersey State Department of Health for the past 3 years, will serve as health officer of each municipality in the county which so designates him, and will enforce State statutes and the State and municipal sanitary codes.

Heretofore in New Jersey, licensed health officers have been employed only by municipal boards of health or regional health commissions.

Preventive Drinking

Information designed to prevent rather than treat alcoholism is found in "Social Drinking," by Dr. Giorgio Lolli, World Publishing Company, Cleveland, 1960. Dr. Lolli is the author of a paper on nurses for alcoholics, *Public Health Reports*, August 1956, p. 727.

Yolo County Shines

California's Health, semimonthly report of the California State Department of Public Health, reproduced in its May 1 issue the 1959 annual report of Yolo County, in its entirety, as a picture of current public health problems and activities.

Old Folks in Traffic

"The Senior Citizen in Traffic" and "The Aging Pedestrian" are discussed in *Traffic Safety*, August 1960. A few reprints are available on request to the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Retiree Jobs

Two retirees, aged 65 and 72 years, have been hired by the New Jersey Highway Authority as toll collectors. Their 40-hour a month work schedule allows them to continue receiving Social Security payments without exceeding the $1,200 annual earnings limitation. The Authority will offer positions at the Irvington, Montclair, and Hackensack exits to approximately 10 men aged 65 or over. Physical, aptitude, and psychological examinations are required for prospective employees. They will work 3 or 4 hours a day, 3 days a week.

Military Surgeons

More than 2,000 American and international physicians, dentists, veterinarians, nurses, and medical specialist delegates will attend the 67th annual convention of the Association of Military Surgeons October 31 through November 2, 1960, at the Mayflower Hotel in Washington, D.C. The theme of this year's convention is "The Military Role in Medical Progress." Dr. Detlev W. Bronk, president of the American Academy of Sciences, will deliver the keynote address at 9:30 a.m., Monday, October 31. Panels will discuss cholera and radiation.

Periodic Physicals

In advocating periodic physical examinations and urging general practitioners to spend more time on preventive medicine, Dr. Norbert Roberts, assistant professor of occupational medicine at the University of Pennsylvania, stated:

- Some previously unknown disease considered "significant" has been found in one of four adult males by periodic checkups, and a known disease for which the patient is not under medical care has been uncovered in an additional one of five.
- Examinations provide baseline data of inestimable value in subsequent treatment.
- Results of the examinations are helpful in disease research.

Dr. Roberts suggested that busy doctors schedule one periodic physical a day. He pointed out that 6 unsuspected malignancies were discovered among the 600 members of the American Academy of General Practice who had complete physicals during the last annual meeting.

PHR SYNOPSES

SCATTERDAY, JAMES E. (Florida State Board of Health), SCHNEIDER, NATHAN J., JENNINGS, WILLIAM L., and LEWIS, ARTHUR L.: ***Sporadic animal rabies in Florida. Public Health Reports, Vol. 75, October 1960, pp. 945–953.***

Rabies in wildlife and domestic animals has been the subject of intensive study in Florida during the past 5 years. Vaccination and local quarantine have been credited with reducing the number of rabid animals encountered and have almost eliminated endemic rabies in dogs. Sporadic cases in wildlife have assumed major importance.

Sporadic cases of rabies are believed to be related to an inapparent reservoir in nature. The quest for a reservoir was intensified after the infection was found to be widespread in insectivorous bats.

Isolated cases of rabies in dogs, house cats, foxes, raccoons, and skunks were investigated for clues to the existence of an inapparent reservoir of the disease. Three hypotheses were suggested by the evidence at hand. First, there is the possibility that the bat or some other small mammal species is the primary reservoir and may infect carnivores directly. Second, it is possible that some of our recognized vector species support enzootic rabies which goes undetected because of irregularities in surveillance, or because of the usually benign behavior of rabid individuals. A third possibility is that several different species of wild carnivores together maintain temporary transmission chains for enzootic rabies, but the patterns of transfer within a species or between species are not clear.

Present data in Florida indicate that dogs, foxes, and, possibly, raccoons support epizootic rabies; bats may support epizootic rabies, while house cats and skunks apparently do not. The possibility of there being some wildlife reservoir for rabies in Florida has been suggested; further study to determine its identity and mode of transmission of the infection is indicated.

MADDY, KEITH T. (Public Health Service), CRECELIUS, H. GILBERT, and CORNELL, RICHARD G.: ***Distribution of Coccidioides immitis determined by testing cattle. Public Health Reports, Vol. 75, October 1960, pp. 955–962.***

From various areas of each county of Arizona, 11,643 home-raised cattle 1–6 years of age were coccidioidin tested, and 2,859, or 24.6 percent, were found to be positive. Whereas previous human skin test surveys have given only indefinite indications of the extent of the endemic areas, this study revealed rather definite boundaries and the relative infectivity of various parts of the endemic area of the State. The endemic areas were found to be practically co-terminous with the Lower Sonoran Life Zone.

The low altitude areas of Yavapai and Mohave Counties and additional areas of Gila County were established as endemic areas for the first time, and several areas of the State of above 5,500 feet altitude, previously in a suspect classification, were found to be noninfective to cattle.

The annual conversion rates for cattle, calculated by the Manos method, were almost identical with the actual human infection rate per year in those counties where this relationship was studied.

Information for Contributors

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Malaria Control and Population Pressure in Ceylon

HARALD FREDERIKSEN, M.D., M.P.H., D.T.M.&H.

THE HISTORY of Ceylon is frequently cited as an example of the demographic effects of malaria control. A reduction in the death rate (for all causes of death) from 20.3 in 1946 to 14.3 in 1947 has been attributed to malaria control through the residual spraying of insecticides (*1–8*). The reduction in the death rate with a relatively constant birth rate has led to the widely publicized conclusion that malaria control had caused a "population explosion" (*4–11*), which in turn has led to predictions of impoverishment and famine in Ceylon as ultimate results of malaria control (*6*, *10*).

The conclusion that malaria control was primarily responsible for the reduction in the death rate of Ceylon in 1947 arose from the coincidence of the drop in the death rate with the extension of residual spraying of insecticides. This conclusion implied that the control, as well as the problem of malaria, affected a major proportion of the population. However, surveys conducted prior to the campaign indicate that 62 percent of the population of Ceylon resided in essentially nonmalarious districts, whereas residual spraying was confined to the area with endemic malaria (table 1).

The first year that a substantial proportion of the population exposed to malaria was protected for a full year was 1947. Those protected in that year represented 28 percent of the population of Ceylon. But the semiannual death rates of Ceylon indicate that the most dramatic reduction in the death rate (all causes) had already taken place in the second half of 1946, when only 18 percent of the national population had been protected from malaria. The protection of 18 percent of the population of Ceylon does not seem to explain the 25 percent reduction in the death rate of all Ceylon from 21.3 in the second semester of 1945 to 15.4 in the second semester of 1946 (table 2).

The pronounced decline in the death rate in the second semester of 1946 invited a comparison of the mortality experience in the malarious and nonmalarious areas of Ceylon at that time. The number of deaths (all causes) in the second semester of 1946, when compared with the number of deaths in the second semester of 1945, declined 24 percent in the unprotected nonmalarious area and 26 percent in the malarious area, or 25 percent overall. The difference between the 25 percent decline in mortality for all Ceylon and the 24 percent decline in mortality in the unprotected nonmalarious area of Ceylon is insufficient to establish malaria control as the significant factor for the dramatic decline in mortality for Ceylon during the second semester of 1946 (tables 3 and 4). Further comparisons of the mortality experience in the malarious and nonmalarious areas fail to provide evidence that malaria control had been the sole or major factor in the postwar decline in mortality in Ceylon (tables 3 and 4).

The death rate (all causes) of Ceylon had been displaying a downward trend at least since 1905. The downtrend was interrupted during the latter part of the Second World War and in 1935, when a disastrous drought was associated with a sharp rise in mortality, attributed

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Table 1. Population, area, and population density of districts of Ceylon grouped by the endemicity of malaria in the districts

Endemicity of malaria	Spleen rates[1] (percent)	Population[2]		Area		Population density per square mile
		Number	Percent	Square miles	Percent	
Not endemic	0–9	4, 142, 889	62	5, 113	20	810
Moderately endemic	10–24	1, 207, 569	18	5, 271	21	229
Highly endemic	25–49	994, 495	15	8, 460	33	118
Hyperendemic	50–74	312, 466	5	6, 489	26	48

[1] Average of surveys in 1939 and 1941.
[2] 1946 census.

SOURCES: Ceylon Department of Census and Statistics, Census of Ceylon, 1946, and reports of the Government of Ceylon submitted to the World Health Organization Malaria Conferences at Bangkok, September 1953, and Taipei, November 1954.

to malaria acting singly or in combination with dysentery and famine. Following are the annual death rates (all causes), based on the estimated population in the respective years, for Ceylon from 1905 through 1953.

Years	*Death rates*	*Years*	*Death rates*
1905–1914	31. 0	1943	21. 4
1915–1924	29. 1	1944	21. 3
1925–1934	23. 6	1945	22. 0
1934	22. 9	1946	20. 3
1935	36. 6	1947	14. 3
1936	21. 8	1948	13. 2
1937	21. 7	1949	12. 6
1938	21. 0	1950	12. 6
1939	21. 8	1951	12. 9
1940	20. 6	1952	12. 0
1941	18. 8	1953	10. 9
1942	18. 6		

SOURCE: Reports of the Registrar General on Vital Statistics, Ceylon.

Comparison of population density and malaria endemicity reveals a reciprocal distribution of population and malaria in Ceylon. The population density of the nonmalarious area was 17 times that of the area with hyperendemic malaria (table 1). The ancient civilization of Ceylon had centered in the area with hyperendemic malaria. The ruins of 10,000 dams testify to the level and magnitude of this civilization in successive stages of history. Decay of the ancient order was associated with collapse of the irrigation systems, emergence of conditions that favored transmission of malaria, and retreat of the Singhalese to the nonmalarious area of the island.

Elimination of endemic malaria, which had become a barrier to resettlement and development of the major part of Ceylon, may serve to reduce the population pressure in the congested area by removing the disease which had restricted the majority of the population to one-fifth of the island territory (table 1). Malaria control will permit full use of the resources in the area which is relatively underpopulated and underdeveloped (see chart).

Table 2. Percentage of population protected against malaria by residual spraying of insecticides and semestral death rates (all causes). Ceylon, 1944–53

Year	Semiannual death rates[1]		Percent of population protected
	First semester	Second semester	
1944	21. 6	21. 1	0
1945	22. 6	21. 3	3
1946	25. 1	15. 4	18
1947	15. 2	13. 2	28
1948	13. 5	13. 2	40
1949	13. 0	12. 1	36
1950	12. 3	12. 9	35
1951	13. 1	12. 7	36
1952	12. 3	11. 7	38
1953	10. 8	11. 1	36

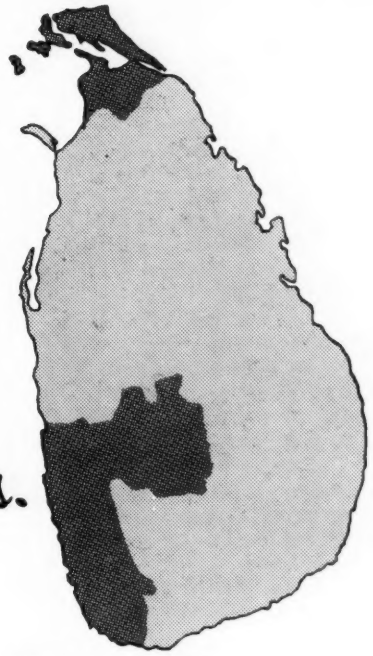
[1] Based on estimated population in the respective years.

SOURCES: Reports of the Registrar General on Vital Statistics, Ceylon, and reports of the Government of Ceylon submitted to the World Health Organization Malaria Conferences at Bangkok, September 1953, and Taipei, November 1954.

Prior to the malaria control campaign,

62 percent of the population of Ceylon

lived in essentially nonmalarious districts.



"Although Ceylon is a small country which is primarily agricultural, nearly two-thirds of the Island has been uncultivable chiefly owing to the dreaded disease, malaria. With the removal of malaria today, a serious menace to the country, it will be possible to open up these vast tracts of land considerably to improve the living conditions of the people, the majority of whom hitherto have been living in poverty and misery" (*12*).

This analysis of mortality in Ceylon should quiet unfounded fears that malaria control in-

Table 3. Deaths (all causes) in the malarious and nonmalarious areas of Ceylon during the second semesters, 1944–48 and 1953

Second semester	Malarious area [1]	Non-malarious area [2]	Ceylon
1944	26, 346	39, 842	66, 188
1945	29, 932	39, 466	69, 398
1946	22, 186	30, 058	52, 244
1947	18, 389	28, 310	46, 699
1948	17, 126	29, 175	46, 301
1953	17, 511	27, 667	45, 178

[1] Districts with spleen rates from 10 to 74 percent (surveys of 1939 and 1941).
[2] Districts with spleen rates from 0 to 9 percent (surveys of 1939 and 1941).

SOURCES: Same as for table 2.

Table 4. Death rates (all causes) in the malarious and nonmalarious areas of Ceylon during the second semesters, 1944–48 and 1953

Second semester	Malarious area [1]	Non-malarious area [2]	Ceylon
1944 [3]	21. 0	19. 2	19. 9
1945 [3]	23. 8	19. 1	20. 8
1946 [3]	17. 6	14. 5	15. 7
1947 [3]	14. 6	13. 7	14. 0
1948 [3]	13. 6	14. 1	13. 9
1953 [4]	10. 9	11. 3	11. 2

[1] Districts with spleen rates from 10 to 74 percent (surveys of 1939 and 1941).
[2] Districts with spleen rates from 0 to 9 percent (surveys of 1939 and 1941).
[3] Based on census population of 1946.
[4] Based on census population of 1953.

SOURCES: Ceylon Department of Census and Statistics, Census of Ceylon, 1946 and 1953, and Reports of the Government of Ceylon submitted to the World Health Organization Malaria Conferences at Bangkok, September 1953, and Taipei, November 1954.

vites famine. The available evidence fails to establish malaria control as the sole or major cause of a population explosion in Ceylon. At the same time, malaria control has made habitable what was in ancient times the most populous and productive area of the island. It appears that in Ceylon the net demographic effect of malaria control for the present could be to reduce population pressure by providing more living space.

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(5) Decade of declining death rates. Population Bulletin. Population Reference Bureau, Inc., March 1957.

(6) World-wide war on malaria. Population Bulletin. Population Reference Bureau, Inc., March 1958.

(7) U.S. Department of State: World population trends and problems. Intelligence Report No. 8057. Washington, D.C., July 23, 1959.

(8) Wilcox, F. O.: World population and economic development. U.S. Dept. State Bull. 42: 860–867, May 30, 1960.

(9) New York Times 109: 1, Nov. 29, 1959.

(10) Life Magazine 48: 158, Nov. 23, 1959.

(11) Time Magazine 75: 19, Jan. 11, 1960.

(12) Bandaranaike, S. W. R. D.: In a speech in 1950, *quoted in*, 10 years of health progress, 1947–57, Ceylon. Colombo, Ceylon, Department of Health, 1959.

New Diagnostic Test for Lupus Erythematosus

A simple diagnostic test which allows accurate screening of large numbers of patients for disseminated lupus erythematosus in a short time has been developed by public health scientists at the National Institutes of Health, Public Health Service.

A connective tissue disease related to rheumatoid arthritis, lupus erythematosus is far more common than indicated by past statistics. Manifestations may include blood, kidney, or nerve disorders, mental disease, arthritis, and butterfly rash of the face and may appear simultaneously. There may be no serious complications for years, but in its acute, disseminated form, it is frequently fatal.

The test, similar to that devised earlier for rheumatoid arthritis, consists of adding a drop of the patient's serum to bentonite sensitized by desoxyribonucleic acid. If the disease is present, flocculation occurs after about 15 minutes of agitation.

Clinical results are described by John Bozicevich, who heads the Basic Immunology Section, Laboratory of Immunology, and Dr. John P. Nasou and Dr. Donald E. Kayhoe of the Laboratory of Clinical Investigations in the National Institute of Allergy and Infectious Diseases, Public Health Service, reporting in the *Proceedings of the Society for Experimental Biology and Medicine*, March 1960.

Advantages of the test are the elimination of the need for fresh whole blood, required by the cell test, and its high specificity. Six persons with frank rheumatoid arthritis gave positive reactions for lupus with the former test, but all were found negative with the flocculation test. Tests on eight lupus patients were conducted with complete agreement in results with the older procedure. For controls, 138 serum specimens from normal individuals or from patients with related and unrelated diseases were appraised, with negative reactions.

More details of the test appear in the *New England Journal of Medicine* for July 7, 1960.

STATEMENT

By Leroy E. Burney, Surgeon General, Public Health Service, August 24, 1960

Oral Poliovirus Vaccine

During recent months, a number of conferences have been held at which progress in the field of immunization with live poliovirus vaccines was reported. These conferences include the meeting held in Moscow in May, the joint Pan American Health Organization-World Health Organization Conference held in Washington in June, and the 5th International Congress on Poliomyelitis held in Copenhagen in late July. The staff of the Public Health Service and its Advisory Committee on Live Poliovirus Vaccine has given careful consideration to the information available from these meetings—indeed, some members have actively participated in these meetings.

It may be recalled that about a year ago recommendations relating to the manufacture and testing of live poliovirus vaccines were issued to facilitate the entry of interested manufacturers into this complex field. Last week, the committee met with the manufacturers and other interested persons in order to review these recommendations.

Revisions to these earlier recommendations, which will serve as the basis for adoption of regulations for manufacture and testing of the vaccine, have been agreed to by the committee. These include the virus strains to be used, the general processes of manufacture to be followed, tests to be applied during manufacture, and factors relating to the continued safety, purity, and potency of the vaccine.

The Service's Division of Biologics Standards is moving with all speed to complete technical details of the final regulations while the manufacturers proceed with preliminary steps toward meeting these requirements. These details will be available in the near future.

In addition, I have received a general short report from the committee. On the basis of these recommendations, it is considered that live poliovirus vaccine is suitable for use in the United States. It is now possible to visualize the licensing of the establishments for manufacture and sale of these products when manufacturers have individually demonstrated the necessary experience and ability to produce material which conforms with the requirements.

It is not anticipated that the vaccine will be available in any quantity for a number of months, and it is doubtful whether substantial supplies will be available before mid-1961. In any case, I consider it important to note the committee's recommendation for the integrated use of the live poliovirus vaccine with the presently available vaccine and for the rather special requirements concerning use of live poliovirus vaccine in the American population. I shall take up certain of the problems raised by the committee regarding the optimal use of live poliovirus vaccine in the United States with appropriate advisory groups, such as the State and Territorial health officers and representatives of the medical and health professions and of the voluntary health agencies.

COMMITTEE RECOMMENDATIONS

The Public Health Service Committee on Live Poliovirus Vaccine considers that field studies of oral poliovirus vaccines have advanced our knowledge to a stage where recommendations relating to its manufacture can now be written.

The committee also has considered the need for careful analysis of the problems associated

with adapting such vaccines to immunization programs in this country and made recommendations thereon.

Vaccine Characteristics and Strain Selection

In line with its efforts to further the progress of immunization against poliomyelitis, the committee met on August 19, 1960, with technical representatives of potential manufacturers, with other interested persons, and with the staff of the Division of Biologics Standards, National Institutes of Health, for the purpose of reviewing the proposed requirements for the manufacture and testing of live poliovirus vaccine. The amended requirements which outline the manufacturing and testing objectives will become available shortly from the Division of Biologics Standards and should be helpful in assisting those manufacturers who wish to enter into production. It is hoped that manufacturers can proceed without delay to develop the necessary experience for the mass production of live oral poliovirus vaccine.

The committee feels that three factors when considered together make possible its recommendation regarding strain selection. These factors are: (*a*) Neurovirulence in monkeys, (*b*) viremia in man, and (*c*) field experience with all candidate strains. The committee again emphasizes the need for definitive information on the question of viremia in man.

The committee considers that of the strains available for preparing live oral poliovirus vaccine the Sabin type 1 and type 2 strains possess the most favorable laboratory and field characteristics and recommends their use. The committee also recommends the use of the Sabin type 3 strain which is satisfactory from the point of view of neurovirulence although it has less than optimum immunogenic capacity and shows a tendency to change its neurovirulence characteristics after passage in man. The committee urges the continued search for a superior type 3 strain. All candidate strains other than those of Sabin which have been studied extensively are of greater neurovirulence for monkeys than the selected reference.

The committee expresses the view that neurovirulence for monkeys is the most important laboratory criterion available. This criterion was used for selecting candidate strains and is still the only measurable laboratory property which can be assumed to be correlated with neurovirulence in man. On the basis of the information available, the committee recommends that the intrathalamic test in monkeys be adopted as the criterion for neurovirulence and that in order to be suitable for vaccine manufacture strains should exhibit little or no evidence of neurovirulence when inoculated in this manner into monkeys. The committee considers that any strain which shows neurovirulence for monkeys by causing paralysis when administered by the intramuscular route is unsuitable. The committee recommends that the intraspinal test be retained mainly as a measure of the susceptibility of the monkeys used. It recommends that the Sabin type 1 strain be used as a reference in the conduct of these tests.

The committee took cognizance of the great contributions of Dr. Herald Cox and of Dr. Hilary Koprowski, who with their colleagues promulgated the concept of live oral poliomyelitis vaccine and, using their own attenuated strains, provided much of the crucial information which advanced the development of this new vaccine.

The committee concludes that the field data now available indicate that while good levels of immunity can be obtained under certain conditions such levels can only be assured by repeated doses. Schedules of administration will depend upon local conditions since capacity "to take" or "immunogenic effectiveness" of these vaccines is influenced by a number of factors, the most important of which is the prevalence of other enteroviruses in the community being immunized. The committee does not believe that the capacity to immunize of any strain is such that the neurovirulence requirements should be compromised.

Need for Planned Use of Oral Vaccine

In view of the fact that the nationwide programs with killed virus vaccine failed to achieve the hoped-for elimination of all epidemics of paralytic poliomyelitis, the committee emphasizes the need for critical assessment of the place of live poliovirus vaccines in the overall picture of poliomyelitis prevention in the

United States. The uncoordinated use of live poliovirus vaccine is unlikely to accomplish more than has been achieved with inactivated poliomyelitis vaccine as presently employed. It appears probable that only a unified national program which utilizes each of the available types of vaccine to its best advantage can accomplish the total prevention of outbreaks.

The committee must also emphasize that when live poliovirus vaccine becomes available generally in this country, its use will be more appropriate on a community than on an individual basis. This will depend upon a number of factors, and special recommendations will be necessary for the guidance of physicians, public health officials, and others who will be engaged in such programs. Attention should be given to such matters as administration to special groups; for example, very young children, pregnant women, susceptible adults, and others, and even more important is the planned continuation of this program as long as necessary to achieve and maintain the required results.

The committee supports the view that the Public Health Service has a function to perform, extending beyond its regulatory responsibilities, to the end that a satisfactory live poliovirus vaccine may not only be made available at an early date, but may be properly integrated into the total pattern of infectious disease prevention in the United States.

Because of the unique nature of live poliovirus vaccine, with its capacity to spread the virus in a limited manner to nonvaccinated persons, the committee cannot make recommendations for manufacture without expressing concern about the manner in which it may be used. The seriousness of this responsibility can be illustrated, for example, by the known potentiality of reversion to virulence of live poliovirus vaccine strains, and the possible importance of this feature in the community if the vaccine is improperly used.

For example, the vaccine has been employed largely in mass administrations where most of the susceptibles were simultaneously given the vaccine, thus permitting little opportunity for serial human transmission; or, it has been administered during a season of the year when wild strains have usually shown limited capacity for spread. This experience should provide the basis for developing usable practices for the United States.—*Respectfully submitted by the Committee on Live Poliovirus Vaccine, Robert Murray, M.D., chairman.*

Education Notes

Department of Radiological Science. The Johns Hopkins University School of Hygiene and Public Health is establishing a new department of radiological science which will be concerned with all aspects of the radiation health picture. The department will train radiological health specialists and research workers for both national and international service. Dr. Russell Morgan, chairman of the National Advisory Committee on Radiation will head the department.

Ph.D. in Administrative Medicine. Columbia University's School of Public Health and Administrative Medicine will offer a new degree program to provide essential training for research in administrative medicine, beginning with the 1960–61 academic year. This program, like all Columbia Ph.D. programs, will be administered by the graduate faculties of the university.

It is anticipated that qualified applicants will be chosen from those with previous training in administrative medicine, public health, medicine, or the social sciences. The program offered should equip graduates for research careers, for teaching positions, or, in certain specialized situations, for positions in the practice of administrative medicine demanding deep insights and wide responsibilities.

Further information on the program, and admission requirements, may be obtained from Dr. Ray E. Trussell, director, Columbia University School of Public Health and Administrative Medicine, 600 W. 168th St., New York 32, N.Y.

Summary of Proceedings

Soviet-American Discussions on Poliomyelitis Control

Certain views expressed in this statement have been modified by developments noted in the statement by Surgeon General Leroy E. Burney, pp. 869–871.

IN PARTIAL fulfillment of an agreement between the Ministry of Health of the U.S.S.R. and the Public Health Service for the exchange of views and information regarding matters of health, a meeting was held in Moscow, May 12–16, 1960, to discuss problems relating to the control of poliomyelitis. In attendance were 28 participants, 15 from the Soviet Union and 13 from the United States.

Session I

The first session, May 12, 1960, was devoted to Russian experience with the live attenuated vaccine strains of Sabin. A published preliminary report of their mass administration in the U.S.S.R. had been made available to the participants, and Dr. M. P. Chumakov (Institute for Poliomyelitis Research, Academy of Medical Sciences (AMS), U.S.S.R.) opened with comments on their experience. He emphasized that the decision to offer vaccine to all persons aged 2 months to 20 years in the U.S.S.R. was made only after thorough discussions of sequentially larger trials, first with Sabin's original lots and later with Soviet-produced progeny lots which had confirmed prior claims as to safety and capacity to induce antibody development. Observations related to the vaccination of 15 million children during 1959 permitted Dr. Chumakov to draw certain definite or tentative conclusions and to delineate problems requiring further study. Since an estimated 700,000 triple negatives had received vaccine without detected ill effect and since study of 1,000 paired serums had indicated a high rate of sero-conversions, safety and serologic effectiveness are felt to have been fully demonstrated. Also, convenient and effective methods for administration have been developed. Although observation for another 2 or 3 years is necessary to provide final confirmation, observations in the latter half of 1959 in Estonia and Lithuania as to epidemiological effectiveness encourage Dr. Chumakov to hope for a radical solution of the problem of poliomyelitis in the U.S.S.R. within 1 or 2 years. Important remaining problems include interference by other enteroviruses, duration of immunity, and final proof of epidemiological effectiveness. For the future, annual trivalent revaccination is planned until the duration of immunity is established. Also, recently born children will be vaccinated systematically.

In a second presentation, Prof. O. V. Baroyan (Ivanovsky Institute of Virology, AMS) described a placebo-controlled trial of the Sabin vaccine. Available data confirm the negligible occurrence of reactions or poliomyelitis related to vaccination, but another year of observation is required to provide evidence regarding epidemiological effectiveness. If vaccine did indeed provoke disease, the cases did not exceed 7 per 1 million.

The related discussion revolved about a number of principal points. Regarding safety, the major concerns were the problem of distinguishing poliomyelitis cases possibly provoked by vaccine from those due to wild viruses and the significance of virus reversion to neurovirulence during human passage. In relation to effectiveness, including duration of immunity, several necessary aspects were stressed, includ-

ing continuing intensive surveillance for clinical disease, periodic sampling for persisting sero-immunity, and continuing virologic surveillance to determine the prevalence of poliovi-ruses. Significant frequency of poliovirus isolates would seem to indicate inadequate intestinal resistance, regardless of antibody persistence, or too many unvaccinated persons. In either case, in the view of Dr. Albert B. Sabin (director of the Children's Hospital Research Foundation in Cincinnati, whose name is carried by the live vaccine), further vaccination would be indicated in an effort to break the chain of wild poliovirus transmission. Sero-response to live vaccine is said to be more rapid and more consistent than to Salk vaccine. The special difficulty of evaluating effectiveness when vaccine is given during an epidemic was pointed out. The U.S. participants were particularly interested in the methods developed for vaccine administration and in how the high general level of popular acceptance was achieved in the U.S.S.R. Finally, it was indicated that contraindications had been specified initially on a priori grounds, but that many have been removed as the result of observations during the emergency use of vaccine in the Tashkent epidemic.

Unfortunately, the experience of Prof. A. A. Smorodintsev was not discussed because he was not able to attend.

Session 2

At the session on May 13, in a series of reports, a number of the U.S. participants described some of the current research in poliomyelitis in their country.

Dr. Roderick Murray (chief of the Division of Biologics Standards, National Institutes of Health, Public Health Service) opened by presenting the preliminary recommendations developed by the Committee on Live Poliovirus Vaccine appointed by the Surgeon General of the Public Health Service, concerning the basis of selection of attenuated poliovirus strains for human vaccination and the licensing of live poliovirus vaccines so as to assure safety, immunogenicity, and purity. The important criteria for strains selection are: (*a*) full documentation of the origin of the strain; (*b*) neurovirulence in monkeys inoculated by the intrathalamic and intraspinal routes to be no greater than that of a reference strain which is subject to selection; (*c*) sufficient genetic stability that strains undergo no significant (word significant yet to be defined in terms of the total experience) change during human passage; (*d*) uneventful use in the field trials including at least 100,000 triple-negative persons; and (*e*) evidence that, in the recommended dosage, the strain will infect and induce antibody formation in at least 90 percent of susceptible persons. For licensing, the manufacturer must show consistent ability to meet established standards by producing at least five successive satisfactory lots. Prescribed control measures, to be described later, are intended to insure potency and exclusion of harmful adventitious agents. Information still needed by the committee relates to: (*a*) significance of observed reversions to neurovirulence; (*b*) evidence of epidemiological effectiveness; (*c*) firm dosage recommendations especially for very young children; and (*d*) more definitive evidence regarding the safety for all candidate strains.

Dr. Sabin described several recent studies. Rapid mass vaccinations with trivalent vaccine in Toluca, Mexico, seem to have revealed a way to vaccinate successfully in the massive presence of other enteroviruses. In New York, Cleveland, New Orleans, and Nashville, immunization of newborn and older infants is under study. Although the data are incomplete, it is already clear that trivalent feeding of newborn infants is unsatisfactory because the type 2 virus multiplies predominantly. However, when only type 1 vaccine was fed, multiplication was demonstrated in 90 percent of newborn children. Nonetheless, a decision regarding its use in newborns is being postponed until further evidence is obtained of antibody and intestinal resistance to reinfection at 6 months of age. Several strains, representing all three virus types, have been completely freed of monkey neurovirulence by selective propagation at 25° C. Unfortunately, the type 1 and type 2 "cold mutant" strains have little or no ability to multiply in the human intestine; however, the type 3 strain does multiply but requires further study. At present in progress is a large-scale vaccination program intended to reach all school and preschool children in

Participants

U.S. participants in the Soviet-American discussions on poliomyelitis, which took place in Moscow May 12–16, 1960, were: Dr. M. Benyesh-Melnick, Baylor University School of Medicine, Houston, Tex.; Dr. Theodore Boyd, National Foundation, New York City; Dr. Victor Cabasso, Lederle Laboratories, Pearl River, N.Y.; Dr. Eugene Flipse, School of Medicine, University of Miami, Miami, Fla.; Dr. John P. Fox, Institute for Public Health Research, New York City; Dr. Thomas Francis, professor of epidemiology, University of Michigan, Ann Arbor; Dr. Hilary Koprowski, Wistar Institute, Philadelphia; and Dr. Herman Kleinman, Minnesota Health Department, Minneapolis.

Dr. Alexander Langmuir, Communicable Disease Center, Public Health Service, Atlanta, Ga.; Dr. Joseph E. Melnick, professor of virology and epidemiology, Baylor University School of Medicine, Houston, Tex.; Dr. Roderick Murray, Division of Biologics Standards, National Institutes of Health, Public Health Service; Dr. David E. Price, Assistant Surgeon General, Public Health Service; and Dr. Albert B. Sabin, director, Children's Hospital Research Foundation, Cincinnati, Ohio.

Participants from the U.S.S.R. included the following from the Academy of Medical Sciences: Dr. V. M. Zhdanov, Academic Secretary; in the Institute for Poliomyelitis Research, Moscow, Dr. M. K. Voroshilova, chief of the Laboratory of Immunology; Dr. S. G. Dzagurov, deputy director of production; Dr. N. A. Zeitlyonok, deputy director of scientific research; Dr. V. A. Lashkevich, chief of the vaccine laboratory; Dr. A. A. Smorodintsev, chief of the Department of Virology, Institute of Experimental Medicine, Leningrad; Dr. A. V. Tyufanov, chief of the Laboratory of Pathomorphological Control of Vaccine; and Dr. M. P. Chumakov, director; and in the Ivanovsky Institute of Virology, Moscow, Dr. O. V. Baroyan, chief of the Department of Epidemiology; and Dr. P. N. Kosyakov, director.

Other U.S.S.R. participants were Dr. O. G. Anjaparidze, director of the Institute of Virus Preparations, Moscow; Dr. N. N. Ginsburg, deputy scientific director, State Control Institute for Medical Biologists; Dr. Y. D. Lebedev, assistant state general inspector, and Dr. L. A. Sakvarelidze, chief of the Department of Epidemiology, Ministry of Health, Moscow; and Dr. V. D. Soloviev, chief of virology, Central Institute of Advanced Courses for Physicians, Moscow.

Cincinnati. A similar program is about to begin in Rochester, N.Y.

Dr. Alexander Langmuir (Communicable Disease Center, Public Health Service) described the recent increase in poliomyelitis in the United States and, in some detail, the 1959 epidemic in Des Moines, Iowa. This outbreak, similar to many other recent outbreaks, was characterized by a change in the epidemiological pattern from that which existed prior to 1955. Lower socioeconomic and poorly vaccinated groups were more severely affected, and attack rates were even higher than previously seen in upper economic groups. He expressed his belief that lack of vaccination in the lower economic groups determined the shift, but that the very high rates probably reflect a change in character of the virus, possibly resulting from restriction, due to vaccination, of the spread of less virulent strains. Several members disagreed with this interpretation.

Dr. Victor Cabasso (Lederle Laboratories, Pearl River, N.Y.) described laboratory studies with the Lederle-Cox strains and other strains which confirmed reports of others, including Dr. Sabin, that the common genetic markers, d, T and MS, do not invariably correlate with neurovirulence and hence should not be referred to as virulence markers. Dr. Joseph E. Melnick (Baylor University School of Medicine) followed by reporting studies of both wild strains and isolates from persons receiving vaccine strains which show that while no single marker is correlated with neurovirulence, changes in one and especially in two markers are associated with a trend toward increased neurovirulence. He pointed out that testing for such in vitro changes is useful in selecting isolates from vaccines for neurovirulence tests in monkeys.

Field trials with the Lederle-Cox strains in Minnesota and Florida were described by Dr. Herman Kleinman (Minnesota Health Department) and Dr. Eugene Flipse (University of Miami School of Medicine). These will have involved about 500,000 persons and include such interesting features as placebo controls and tests for viremia in Minnesota and the search for spread and for influence on wild viruses in Florida. A single administration of trivalent vaccine was reported by both speakers as inducing high rates of sero-conversion.

Finally, Dr. John P. Fox (Institute of Public Health Research, New York City) reported studies of the spread of the Sabin vaccine strains in households and communities in Louisiana. While low economic status (associated with poor household hygiene), young age of the vaccinee, use of the type 3 strain, possibly pharyngeal excretion of virus, and, in the community, heavy seeding of the child population all favor vaccine virus spread, the dominant fact is that the vaccine strains spread much less extensively than the more infective wild strains and tend to die out well before the supply of susceptibles is exhausted. Further, contact infections often are abortive and fail to induce antibody formation. He suggested that in view of the short life expectancy of vaccine strains in the population, great concern about reversion may not be justified.

Session 3

The third session was devoted to a discussion of questions of manufacture and quality control as these affected the safety and potency of live poliovirus vaccine.

Dr. Chumakov introduced the discussion by presenting a general account of the system of control which had been the basis for issuing live poliovirus vaccine for general use in the U.S.S.R. He noted that these were based on instructions prepared largely by Dr. A. A. Smorodintsev which were approved by the Ministry of Public Health on November 10, 1958. These instructions were later amended following conferences with U.S.S.R. health officials following a conference held by Dr. Sabin in June 1959 in Cincinnati and later taking into account some of the recommendations made by the Public Health Service Committee on Live Poliovirus Vaccine.

Dr. Chumakov pointed out that in the U.S.S.R. only three Sabin strains were used, and the following principles were included in the production and control of the product in order to assure safety and effectiveness:

1. Identification of the strains used.
2. The use of usually first and rarely second passage from the seed in preparing vaccine.
3. Careful selection and examination of monkeys for disease.
4. Holding monkeys for 6 weeks. Keeping up to seven monkeys per cage has not been found to be a disadvantage.
5. Separate processing of individual kidney pairs.
6. Use of dense tissue culture preparations with heavy inoculums of the cultures during production of vaccine.
7. Incubation at 34° C. during the virus propagation phase.
8. Use of 25 percent of the tissue culture vessels as control vessels and examination of all culture bottles after 3 days' cell growth prior to inoculation as matters which minimize the simian agent problem.
9. Testing each lot for neurovirulence in monkeys by intracerebral inoculation and every 10th lot by intraspinal inoculation.
10. Performing tissue culture and animal tests designed to pick up various contaminating bacteria and viruses.
11. Carefully determining final virus titers by two methods.
12. In the case of vaccine incorporated into candy, testing up to 110 pieces of candy, randomly selected, for virus content.

Dr. Chumakov indicated that a total of about 4,000 liters of vaccine had been issued; that this represented the production of 61 lots, of which only 4 had been rejected during processing. These rejections were because of positive findings in the intracerebral monkey neurovirulence test. Simian viruses had not been a problem, and B virus had not been encountered.

Dr. Murray briefly summarized the recommendations issued in the United States on November 16, 1959. These followed along parallel lines with some differences. Individual isolation of monkeys was a requirement. Greater emphasis was put on the possible presence of simian and other adventitious agents, and in this connection the test volumes were high; 500 ml. where possible, or 500 recommended doses where neutralizing serums were required in the test. It was emphasized that the extensive experience with tissue-culture testing of killed poliovirus vaccine indicated that simian agents were rather commonly encountered, but that the occurrence tended to be irregular. In addition, the need for the

control of personnel, prevention of entry of extraneous viruses into production areas, and the need for separate facilities for vaccine manufacture were emphasized.

In the ensuing discussion a number of speakers stressed the need for some simple evaluation of safety such as might be presented by an array of markers. There was also emphasis on the important role of continuous epidemiological evaluation in order to support laboratory control measures and because of the possibility that it might be several years before it becomes possible to make a full evaluation of the epidemiological effectiveness of live poliovirus vaccine. By effectiveness is meant prevention of both paralytic disease and circulation of wild polioviruses.

Summary and Conclusions

The occurrence of reactions following the use of these vaccines has been followed in a number of studies, some of which were controlled studies, in the United States and the U.S.S.R. The rate is so low that the product may be considered virtually areactive. Multiplication of virus has not been accompanied so far by any certainly detected evidence of illness. The status of the few cases of poliomyelitis which have occurred shortly after vaccination has not been clarified.

On the basis of the experience with large-scale feeding of the Sabin vaccines, involving some 60,000,000 in the U.S.S.R. alone, no cases of poliomyelitis which could be attributed to the use of these vaccines have been reported from the various areas of the world where they have been used.

On the question of increase in virulence, while there was little direct evidence that this did not occur, the epidemiological information available indicated that this had not been encountered.

Much of the data indicated that live virus vaccines induced antibody formation in a high proportion of susceptible children. Single use of trivalent vaccines, especially in young infants, was often reported to result in lesser frequency of response than that following sequential monovalent feeding, although various workers in both countries have reported satisfactory results.

Vaccination during summer months on occasion has been followed by a significant proportion of failures, possibly because of the interfering effect of other enteroviruses. Evidence exists that rapid initial mass application of trivalent vaccine followed by reapplication may overcome this difficulty.

A hoped-for advantage of live virus vaccination voiced by many participants is intestinal resistance to infection. It has been suggested that, guided by virologic surveillance, periodic revaccination may be practiced annually until this desired level of resistance is achieved.

Information regarding duration of immunity is as yet inadequate. To supply this, periodic serologic sampling of the vaccinated population and continued epidemiological and virologic surveillance are essential.

Several observations compatible with significant epidemiological effectiveness have been reported. These include: (*a*) the unusually low overall incidence of poliomyelitis in the second half of 1959 in the several areas in the U.S.S.R. in which 50 to 60 percent of the population was vaccinated prior to June and (*b*) the fact that, in the several regions where vaccine was administered during the summer and fall, attack rates in those vaccinated were consistently much lower than in those not yet receiving vaccine. All agreed, nonetheless, that careful surveillance for several more years is necessary to provide full proof of effectiveness.

The production and testing standards in effect in the U.S.S.R. and the United States are parallel in most respects, but there are certain differences.

The existence of these differences suggests the desirability that a comparative study of the different requirements be undertaken by the United States and by the U.S.S.R. so that international recommendations may be formulated by the World Health Organization.

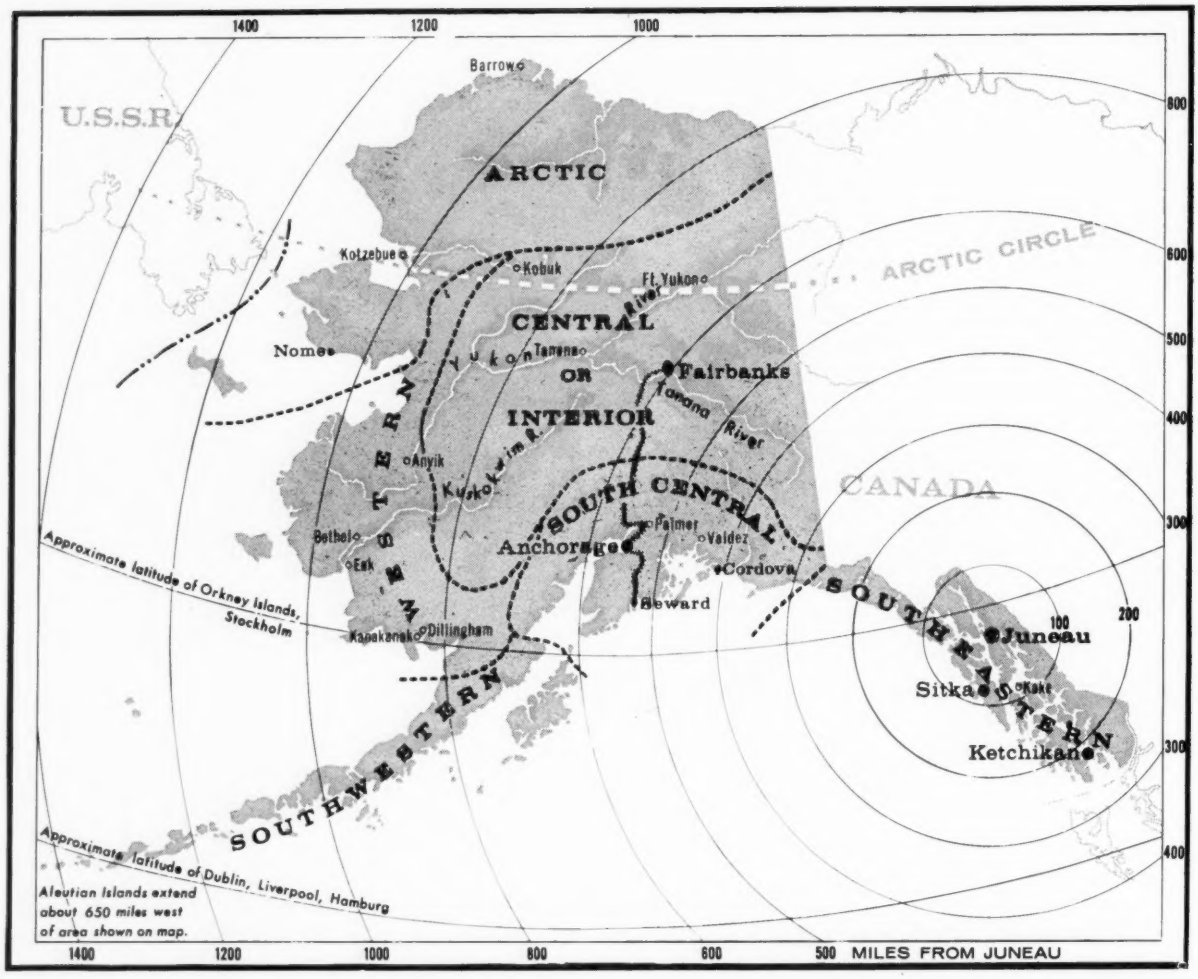
The participants all agree that the work of the conference has been mutually profitable and has laid a firm foundation for the continuing exchange of information and cooperation in the future.—*Signed by* DAVID E. PRICE, Assistant Surgeon General, Public Health Service, and V. M. ZHDANOV, Academic Secretary of Academy of Medical Sciences of the U.S.S.R., May 16, 1960, Moscow.

Chugach Mountains near Anchorage

Photograph by J. Malcolm Greany, Juneau

ALASKA

frontier for health services



ALASKA is in a particularly critical period. The transition from Territory to State presents complex tasks of organization to be accomplished with as little disturbance of functions as is humanly possible. New sources of revenue are to be tapped. New programs are to be initiated. Established services, formerly provided by Federal agencies, are passing to the State.

Alaska is in many respects still a frontier, undergoing settlement and early growth. A large segment of the population is moving from a primitive hunter's culture to the culture of the nuclear age almost in a single generation. Another segment is composed of transient military personnel and their dependents. The remainder is a complex of established settlers, newcomers, and seasonal workers, with multiplying demands for public services.

A review of Alaska's health at this juncture seems timely.

To readers of *Public Health Reports*, Alaska may suggest that we have under the American flag a unique opportunity for technical assistance to an underdeveloped land. Its challenge to health services opens rare opportunities for research and application of present knowledge.

An even higher consideration is that which motivated Dr. Joseph Mountin (*1*) and others to advocate the establishment of an Arctic Health Research Center:

"In the past, public health activities have developed in the wake of civilization. Now public health is presented with an opportunity to lead civilization, to pioneer in new fields. By uncovering some of the problems of human life and adjustment in low temperature areas, public health can become a creative force in opening up new frontiers. At the same time, it can make potentially significant contributions to basic knowledge."

The successful development of Alaska as a home and as a resource for a democratic people depends on what is done to promote the health and vigor of all who live and work there, for this generation and generations to come. It is with this thought above all that the following pages consider the status and development of health in Alaska, the largest and the least developed of the 50 States.

Geography and Climate

From the standpoint of medicine and public health, the most important features of the Alaskan environment are those which influence travel and transportation, communication, construction, and environmental sanitation. Health services in Alaska range over thousands of miles: through climates ranging from the arctic to temperate; from arid to rainy; over glacier, muskeg, volcano, fiord, forest, and frozen plain. Isolated from the main centers of health resources in the United States, Alaskan health services nevertheless bring modern methods to still more isolated settlements, which subsist by hunting, fishing, logging, mining, or herding.

Thanks to aviation and radio, Alaska has succeeded in bypassing many of the physical obstacles of its geography and climate, which formerly made travel hazardous and time consuming and communication uncertain if not impossible. The long distances between settlements, the high mountain ranges, and the expanses of treeless and trackless tundra are no longer as formidable as in years past. In all but the most remote areas, the bush plane is replacing the dog team as the customary means of winter travel for all Alaskans.

All Alaskan bush flights are "WPPW," "weather permitting-pilot willing." For some flights, the plane may take off on wheels and land on pontoons. It may land on a gravel bar in a river, or on frozen tundra, or on a slough or lake. During the fall freezeup and spring breakup travel to outlying areas generally comes to a halt for a few weeks until ground and water conditions stabilize. Construction of additional airfields with surfaced or graveled runways is overcoming the seasonal hiatus, but in remote areas the possibility of seasonal delays from freezing or thawing conditions persists.

The Alaskan bush pilot is often the first to bring back word of outbreaks of disease, food shortages, forest fires, or other disaster. He goes out of his way to check on isolated individuals and to fly in critically needed personnel, food, drugs, or equipment. Between the weekly or biweekly bush flights, dogsleds are usually the only means of winter travel between villages. A few river settlements operate trucks, caterpillar tractors, or snowmobiles on frozen rivers during the winter. A few "Snogoes" (sleds with airplane propellers mounted on the rear) are also used.

In summer, boats with outboard motors travel along the swift, silt-laden streams, through many deltas and sloughs. It takes a skilled navigator to find his way, because the streams may change course from season to season. Kayaks, one-manned, and umiaks, large skin boats, are used by coastal residents for sealing and walrus hunting.

Umiaks, frequently equipped with outboard motors, lighter freight in from the big ships lying offshore along the northwestern coast.

Microwave transmission of long-distance telephone calls, broadcasts, and shortwave radio have speeded up messages. The Army Signal Corps operates the telegraph and long-distance systems in Alaska. Exchanges which only a

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Data and information on which this report is based were obtained from both published and unpublished reports and records and by personal interviews or communications with staff members of State and Federal agencies and organizations. The State agencies were the Alaska Agricultural Experiment Station and the Alaska Department of Health and Welfare. Federal agencies, all within the Public Health Service, were the area office and Public Health Service Hospital, Anchorage, and the field office, Mount Edgecumbe, both of the Alaska Native Health Service, Division of Indian Health, Bureau of Medical Services, and the Arctic Health Research Center, Bureau of State Services. Statistical data are the most recent figures available as of May 1960. Mrs. Rachel Simmet, special assistant to the director, Arctic Health Research Center, Anchorage, was principally responsible for the acquisition, compilation, and presentation of this information.

few years ago required days or weeks are completed in minutes or, at most, hours. For example, in a few minutes a public health field nurse may learn that a hospital bed is available for a patient waiting in Sleetmute, and the patient may be brought to the hospital, weather permitting, within a few hours or a few days. Regular longwave broadcasts also carry personal messages which might otherwise be delayed.

Physicians at field hospitals hold regular daily conferences by radio, answering questions and giving instructions for teachers, missionaries, and village leaders.

Alaska's highway and railway facilities, access roads, and airfields are being extended in anticipation of population needs. Present systems of travel and communication in general demonstrate high achievements against extreme odds.

Actually, there are only two phenomena which are truly peculiar to northern regions. Extremely low temperatures, invariably regarded as the outstanding feature of Alaska, also occur in many of the northern States lying along the Canadian border. But permafrost and extreme periods of darkness and light occur only in the arctic and subarctic. Permafrost, a major obstacle to Alaskan development despite years of study and experiment, is the layer of permanently frozen ground which underlies a considerable portion of all land masses bordering on the Arctic Ocean. About 60 percent of Alaska's 586,000 square miles is underlaid by this frozen layer. This frozen earth is hard to excavate, and once thawed on the surface there is no drainage through the frozen layer beneath. Wells and sewer or water pipes running through the permafrost will freeze unless special precautions are taken. The foundations of highways and buildings often settle or heave as a result of disturbances in the permafrost. Other specific effects of permafrost are discussed below.

The second environmental factor peculiar to northern latitudes is the light cycle which gives Alaska its long summer days and long winter nights. While the specific effects of protracted light or darkness on human beings have been investigated only to a limited extent, there has been considerable speculation concerning the relation of the long nights to mental health. A condition popularly known as "cabin fever" is sometimes ascribed by amateur Alaskan psychologists to the period of winter darkness, but no scientific evidence has been assembled to support or contradict this theory. Studies are underway to determine the effects of the protracted length of summer days on certain public health procedures, such as the operation of sewage oxidation ponds.

Population

In general composition as well as in the more specific characteristics of age, heredity, sex, geographic distribution, and mobility, the Alaskan population is in a class by itself. For this reason, comparison of Alaskan data with data for other States or for the United States as a whole, while inevitable, is unlikely to lead to sound conclusions unless Alaska's unique population and environment are also evaluated.

Certain basic characteristics of the general Alaskan population have had special bearing on health and medical care programs.

The presence of aboriginal groups in varying stages of acculturation and economic independence, for example, has encouraged Federal fi-

Float plane on Yukon River at Anvik. River boats and float planes both use Alaska's waterways. When waterways are frozen, dog teams travel on them and ski planes land on them. Itinerant public health nurses, sanitarians, and clinic personnel, as well as patients going to and from hospitals, must "make connections" between small and large craft.

Bureau of Indian Affairs school and village of Noorvik on the Kobuk River in far northern Alaska. In background is part of the vast "Arctic bog," which explains why travel in Alaska is by air, river boat, or dogsled.

nancing of medical care and facilities for such Alaskans. With establishment of parallel services and facilities for other residents, administrative functions in many instances have overlapped in the past.

The word "native" is used in the following pages to designate members of the three aboriginal groups in Alaska as differentiated from individuals born in Alaska of nonaboriginal parents. The term "white" as used in Alaskan data includes a small number of American Negroes and Filipinos as well as Alaska-born white residents and immigrants.

The native population includes an estimated 18,000 Eskimos, 16,000 Indians, and 4,000 Aleuts. The Eskimos, unlike the Indians, have no tribal or clan organization and are generally classified as coastal or inland Eskimos, or by the name of the specific area which they inhabit, such as Brooks Range, Bering Sea, or Pacific Eskimos.

The Indians of southeastern Alaska comprise three tribal groups: Tsimpshian, Tlingit, and Haida. Indians of interior Alaska belong to the Athabaskan, or Athapascan, tribe, with subsidiary groups also designated by location, as, for example, Copper River or Koyukon (Koyukuk and Yukon Rivers) Indians.

The Aleuts, smallest of the three aboriginal groups, are found chiefly in villages of the Alaska Peninsula and the Aleutian Chain.

Alaska has many excellent native artists and craftsmen. Years of dependence on their environment for a livelihood have made them expert observers and reporters of Alaskan natural history and wildlife, with remarkably accurate memories. They have proved to be excellent mechanics, pilots, and scouts, and have made notable contributions to the national defense through service in the Armed Forces, with the Alaska National Guard, and as construction workers on the DEW (distant early warning)

line and White Alice (communications network) installations in remote areas. Nine of the 60 members of the first State Legislature were natives: 6 were Eskimo, 2 Indian, and 1 Aleut. An Eskimo was also elected president of the first State Senate.

For many years now, a high proportion of the wage earners in Alaska have been Federal employees, both military and civilian. This has had considerable influence on local and statewide health programs. Most of the health and medical needs of the individual military man and his dependents are met by services and facilities available only to the military population. Some of the Federal agencies, such as the Alaska Railroad and the Federal Aviation Agency (formerly Civil Aeronautics Administration) have had their own staff physicians. The Alaska Railroad also maintained a separate hospital for many years. Exclusion of these groups has limited the base of financial support for community facilities and services, and has upset the population ratios used in determining per capita needs and financial resources.

The bulk of the Alaskan population is still made up largely of "transplants," those who were not born in Alaska. The backgrounds of these immigrants, the reasons they have migrated north, and the levels of individual capability, emotional maturity, and resourcefulness which they represent profoundly influence the "tone" and development of the communities in which they settle. The get-rich-and-get-out-quick fortune seeker, who comes north without his family, is content with minimum comforts, contributes little to the stability of any community, and frequently aggravates conventional community problems. The individual who migrates north to "get away from it all" seldom contributes to Alaska's development. Fortunately, the proportion of fortune seekers and escapists among the annual swarm of newcomers is decreasing.

Age and Sex

Perhaps the most outstanding characteristic of the Alaskan population is its youth. According to a special 1959 Census Bureau compilation, the median age of the civilian population in Alaska is 18.5 years, while the median age for the United States population as a whole is 30.1. Conversely, Alaska has the smallest number of "senior citizens" of all the 50 States, with only 4.4 percent of the population in the 65 and over age group. This unusual age distribution is important in interpreting mortality and morbidity statistics and in judging the health and medical care needs of Alaskans.

The ratio of males to females in the Alaskan population has decreased in recent years. In 1950, the ratio was down to 162 males per 100 females and has decreased more since then. A large proportion of women are of childbearing age, and the high birth rate is responsible in large measure for the increase in Alaska's population.

Geographic Distribution

Fewer than a quarter million people reside in Alaska. By comparison, Scandinavia and Finland, which closely resemble Alaska in extent and to a considerable degree in climate, had a total estimated population of nearly 19 million in 1957–58 (*2*).

Most of Alaska's present population is concentrated in the vicinity of the four major cities, Ketchikan, Juneau, Anchorage, and Fairbanks, in many small towns and villages along the Pacific, Bering, and Arctic seacoasts, and along the two main rivers, the Yukon and the Kuskokwim.

Alaska has the lowest population density of all the States, with about one person to each 3 square miles. Even with continued growth, such as the 51 percent increase in civilian population between 1950 and 1957, it seems likely that the present pattern of population distribution in Alaska will persist, with the highest concentrations along the temperate coastline and in certain sections of interior valleys.

The 38,000 Indians and Eskimos for the most part live in small, widely dispersed settlements, following early cultural patterns of location and occupation, while newcomers (cheechakos) favor the towns. This basic pattern of distribution has been modified to some extent by technological and cultural changes. As the wildlife resources have dwindled, many native hunters and fishers have migrated to larger communities in search of wage labor. Until

comparatively recent times, the only non-native residents in most of the small coastal and river villages were school teachers, missionaries, traders, or U.S. commissioners. With the expansion of defense construction activities and establishment of Federal Aviation Agency facilities in outlying areas, more and more cheechakos have moved into remote areas. Even in the most isolated regions, there are now few entirely native villages, and in the majority of the settlements most of the native residents, except perhaps the elders, understand and speak English in addition to their own language. Few of the newcomers, in contrast, have succeeded in mastering the Eskimo and Indian dialects.

The rate of acculturation among native groups has varied with geographic location. The ease and speed of cultural transition have been determined largely by the extent of exposure to the white man's industrial culture. Thus, among the Indians of southeastern Alaska, the process of acculturation has taken place far more rapidly and more thoroughly than among the Eskimos living along the Bering Sea and the Arctic Ocean. The transition from subsistence fishing of the early southeastern Indians to employment in commercial fisheries has been far easier than the changes implied for the Eskimo's shift from hunting seal or walrus to dependence on limited opportunities for unskilled wage labor in northwest Alaska (*3*).

Despite the lack of highway and railroad facilities, the Alaskan population is unusually mobile. Seasonal fluctuations in employment in the construction and fishing industries account for much of the traffic between Alaska and other States. There is also considerable population movement within Alaska. In former years, the entire population of many villages customarily moved in season, to summer fishing camps in the spring, to muskrat camps in the fall, or along the winter trail of the caribou herds. Seasonal shifts have decreased to some extent in recent years. As improvements in construction methods have extended the building season, more and more construction workers remain in Alaska the year around. Similarly, as schools and post offices are constructed in outlying villages, nomadic families are less inclined to move away from these fixed facilities. The tendency to "stay put," however, increases the need for sanitation and disease control, and for some formerly nomadic families it has meant limited supplies of food.

Health and Medical Resources

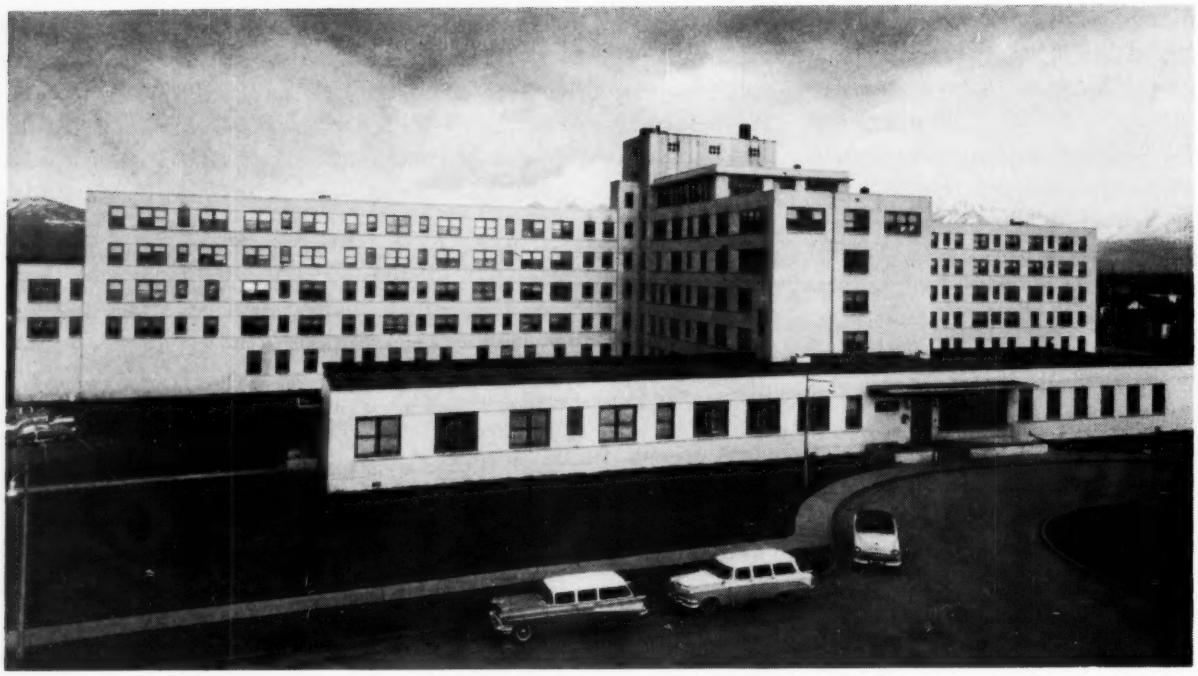
As in other sparsely settled areas, most of Alaska's health and medical facilities and personnel are located in or near major population centers. This distribution pattern is modified in Alaska by the fact that certain facilities were established specifically to serve the Eskimo, Indian, and Aleut population.

Alaska currently has 28 hospitals and 1 nursing home (table 1), 27 health centers, and roughly about 1,500 to 1,800 professional medical and paramedical personnel, including government and private but excluding military employees, to care for the health and medical needs of approximately 175,000 civilians. In general, per capita ratios of hospital beds and professional personnel are relatively low, and

Table 1. Alaskan medical facilities, by type and bed capacity, 1959–60

Type of facility	Number	Bed capacity
Federal Government:[1]		
Public Health Service:		
Referral hospitals	2	700
Field hospitals	5	180
Outpatient clinics	(3)	
Fish and Wildlife Service hospitals[2]	2	14
Total	9	894
Nongovernment:		
Church:		
General hospitals	9	381
Chronic disease hospitals	1	16
Community general hospitals	8	137
Other:		
White Pass and Yukon Hospital[3]	1	8
Private nursing home	1	15
Total	20	557
Grand total	29	1,451

[1] Excluding military hospitals.
[2] Hospitals in Pribilof Islands are staffed by the Public Health Service and operated by the Fish and Wildlife Service.
[3] Railroad.



Alaska Native Health Service Hospital, Anchorage

the distribution of these resources among population groups is somewhat uneven. There are, however, certain factors which offset these apparent deficiencies. One is the unusual age distribution. The population is, on the whole, young and healthy. Second, many Alaskans are still inclined to go "outside" for major surgery or for treatment of long-term illnesses. But the demand for specialized services and facilities located within Alaska is increasing.

Statistical analysis of health and medical resources in Alaska is difficult, because agency functions tend to overlap, and staffing patterns of government agencies vary. As a result of changes brought about by statehood, the general organization and relationships of Federal and State health agencies in Alaska are in a state of transition. The two chief agencies concerned with civilian health are the Division of Health of the Alaska Department of Health and Welfare and the Public Health Service including both the Alaska Native Health Service and the Arctic Health Research Center.

None of the military medical and health resources in Alaska is included in the analysis, since these are available to the general public on an emergency basis only. Special mention should be made, however, of auxiliary services provided by the Alaska Air National Guard, Civil Air Patrol, Coast Guard, Air Force, and Navy, which are frequently called on for aid in searching for downed military and civilian aircraft, to provide emergency transportation for ill or injured residents, or to transport medical and nursing personnel in case of emergency.

Federal Government Facilities

The Public Health Service, in addition to providing medical care for Alaska's natives, has pioneered in studying Alaska's health needs through the Arctic Health Research Center, Bureau of State Services, in cooperation with the Division of Health, Alaska Department of Health and Welfare, and other agencies and organizations in and outside Alaska.

The Public Health Service's Bureau of Medical Services, through its Division of Indian Health, is the unit of Federal Government responsible for providing medical care for the Eskimos, Indians, and Aleuts of Alaska. The activities of the Alaska Native Health Service program of the Division of Indian Health are under the administrative supervision of the area office located at the ANHS hospital in Anchorage. A field health office at the Mount Edge-

cumbe hospital directs the program in southeastern Alaska.

Under the immediate supervision of the Mount Edgecumbe field health office is the 300-bed hospital at Mount Edgecumbe near Sitka, and an outpatient clinic at St. Ann's Hospital in Juneau. Under the Anchorage area office are a 400-bed hospital in Anchorage, five field hospitals distributed throughout northern, western, and central Alaska, and two hospitals operated by the Fish and Wildlife Service on the Pribilof Islands.

In addition to supervising the operation of the hospital at Anchorage and the five field hospitals, the Anchorage area office has a staff of program specialists who direct a comprehensive program related to their individual fields, as well as acting as consultants to Public Health Service field personnel and installations. Through joint effort with the Division of Health, Alaska Department of Health and Welfare, the area office is providing public health nursing and sanitation aide services to native villages under contractual arrangements. The State tuberculosis control program is also jointly supported by the Alaska Native Health Service of the Division of Indian Health, by provision of monetary aid and by direct support of two of the three airborne chest X-ray survey teams serving the State.

The Mount Edgecumbe field health office supervises school health programs at the Mount Edgecumbe School, the only native boarding high school in Alaska, and at Wrangell Institute, a boarding school covering grades 1–8, to which native children are sent from remote villages where no schools are available at present.

Although tuberculosis among the Alaskan natives has been drastically reduced (see table 7), thus diminishing the need for tuberculosis beds, the increased number of patients who need medical and pediatric beds is more than enough to occupy existing hospital facilities, as well as facilities to be replaced at Kotzebue and Barrow. The changing trend from relatively inexpensive long-term care of tuberculosis patients to care of patients with acute general medical and surgical conditions poses several problems. Among these are the fact that a general hospital requires more personnel of more types than a tuberculosis hospital, the cost of transporting the increased number of patients served by a general hospital, and remodeling of facilities.

In order to meet the objective of the Division of Indian Health to elevate the health status of the Alaskan natives to a level comparable with that of the general population of the State, other facilities, such as field health clinics, are also needed. Some field health clinics are already being held by Public Health Service doctors and public health nurses in schools and other temporary quarters in some of the villages; however, no fixed installations are available in many of the smaller villages. The plan is gradually to establish permanent facilities in strategically located areas so that more preventive as well as direct medical care can be made available to the beneficiaries. Fort Yukon will probably have the first such establishment in Alaska.

It has been frequently suggested that Public Health Service field hospitals be open to non-native residents of Alaska, particularly in communities where no other facilities are available. Hospital and outpatient medical and dental care are currently provided in emergency situations only. These non-native patients are requested to reimburse the Public Health Service for the care received, under set scheduled fees or at hospital cost-per-diem rates. This method of operation has been approved by the Alaska State Medical and Dental Associations as well as the Alaska Hospital Association.

Research in Alaska by the Public Health Service is primarily concerned with investigating and, where possible, devising solutions to the many and varied health and medical problems peculiar to the region. This program, conducted by the Bureau of State Services' Arctic Health Research Center at Anchorage, was established by act of Congress in 1948. Initiation of the research program was recommended by two survey teams from the American Medical Association which visited Alaska in 1946 and 1947, with strong endorsement from the Territorial department of health and other Territorial and Federal agencies concerned with Alaska's health.

The Arctic Health Research Center is the only research facility in Alaska with a resident staff devoting full time to health studies. Long- and short-term studies involving field and labora-

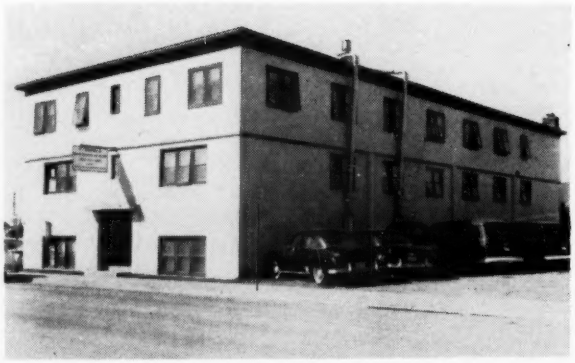
tory investigations in biochemistry and nutrition, entomology, environmental sanitation, epidemiology, physiology, and zoonotic disease are in progress at AHRC. Many of the study projects are pursued in cooperation with the Division of Indian Health, the Alaska Native Health Service, and the Alaska Division of Health. Direct support is provided for investigations in environmental sanitation and epidemiology by the Division of Indian Health. The National Institutes of Health provides partial support for studies in certain fields.

State Government Facilities

The Division of Health of the Alaska Department of Health and Welfare maintains 27 health centers, which constitute the front line of its health activities. Located in small villages as well as urban communities, these centers serve as headquarters for nursing and sanitation personnel between visits to outlying villages. The visits by public health nurses and sanitarians constitute the most arduous and critical health services in Alaska. As noted above, travel conditions are often trying. Accommodations in bush planes are so restricted that passenger size becomes a critical factor in recruiting field personnel.

Since many villages are remote from a field hospital, nurses during their visits often provide emergency aid in addition to routine services. Although housing facilities are being improved, it is not unusual for a visiting nurse or other field visitor to bed down in a sleeping bag on the floor of the school house or trading post.

Many of the health centers and itinerant nursing services were established several years ago by the Office of Indian Affairs, Department of the Interior, as extensions of the field hospitals, primarily for native beneficiaries. As rapidly as finances permit, the Alaska Division of Health is taking over these units and is adding new ones, to provide services for all residents of as many villages as possible. As the health centers and itinerant services are transferred to the Alaska Division of Health, the Public Health Service Division of Indian Health continues to finance the itinerant nursing and sanitation programs on a contractual basis.



Main laboratory building, Arctic Health Research Center, Anchorage

Health center, Kake, June 1958. This health center provided the first adequate quarters for itinerant nurses in this southeastern Alaska village.

Federal funds have been appropriated for construction of a 225-bed State mental hospital at Anchorage, and additional funds have been allocated by the State Legislature for conversion of existing hospital facilities at Valdez for care of custodial mental patients.

The Alaska Division of Health maintains four laboratories, a central laboratory at Juneau and three regional laboratories at Ketchikan, Anchorage, and Fairbanks. The four units provide comprehensive, modern public health laboratory services for the entire area of Alaska. Jointly they supply the bacteriological, serologic, parasitological, radiological surveillance, sanitary bacteriological, and microbiological services essential to the operation and administration of the Division of Health programs.

In addition to routine processing of speci-

Alaska Native Health Service field hospital, Kotzebue

mens sent in by physicians, health officers, public health nurses, and hospitals located in their respective cities, each laboratory receives specimens from numerous villages within a sizable radius. Limited investigative studies are included in the programs as far as routine specimen loads permit. These include the study of newer and more efficient laboratory methods, the scientific analyses of routine laboratory findings, and limited laboratory research on public health conditions peculiar to Alaska.

Special and reference microbiological examinations, including animal pathogenicity studies, are provided through the Division of Health laboratories by the Public Health Service Communicable Disease Center in Atlanta, Ga., and nearby States. A limited amount of special bacteriological, virological, and serologic service is provided by the Infectious Disease and Animal-borne Disease Laboratories of the Arctic Health Research Center.

There are only two resident pathologists in Alaska. One has a small private laboratory in Anchorage; the other is an Air Force officer assigned to Ladd Air Force Base in Fairbanks, who frequently serves as consultant at the Public Health Service hospital in Anchorage. A pathologist from the State of Washington travels to Ketchikan periodically to provide consultation. Many private physicians still send all their pathological and some of their clinical specimens to diagnostic laboratories

outside Alaska. Public Health Service field hospitals maintain small laboratories for simple diagnostic tests, forwarding specimens requiring elaborate processing to laboratories at the Public Health Service hospitals at Anchorage and Mount Edgecumbe.

Private hospitals and physicians' clinics in both the larger and the smaller communities operate clinical laboratories, some of which do only simple diagnostic tests, relying on the larger laboratories for reference and the more exacting procedures.

The Division of Health, in cooperation with the Alaska Society of Medical Technologists, has organized several workshops, conducted by laboratory consultants from the Public Health Service Communicable Disease Center, to expand and improve public health and clinical laboratory services throughout the State.

Private Facilities and Agencies

There are 20 private hospitals and several private medical clinics listed in Alaska. Eighteen of the 20 institutions are classified as general hospitals; one is a chronic disease hospital (Wesleyan Hospital, Seward), and one is a nursing home in Anchorage. Two of the general hospitals are currently closed either because of lack of operating funds (Hudson Stuck Memorial Hospital at Fort Yukon), or inability to recruit and keep staff (Valdez Community Hospital). A total of 526 general hospital beds are therefore available in 16 currently operating hospitals for the care of approximately 137,000 non-native civilian residents of Alaska. Of these 16 private hospitals, only two are located in the whole of interior and northern Alaska, at Fairbanks and Glenallen, and one in western Alaska, at Nome. Six are located in or near Anchorage and the Kenai Peninsula, at Palmer, Anchorage, Seward, Homer, Seldovia, and Kodiak, one at Cordova, and the remaining six in the southeastern Panhandle, at Ketchikan, Wrangell, Petersburg, Sitka, Juneau, and Skagway.

Of the 526 private hospital beds available, 163 are currently classified as "unsuitable" by the Alaska Division of Health. Entire hospitals have been so classified in four communities, usually on the basis of age or type of construction or both.

Ten voluntary agencies supplement official health activities in Alaska. The Alaska Crippled Children's Association and the Alaska Tuberculosis Association have vigorously supported official agency efforts to combat tuberculosis and accompanying orthopedic problems for many years. Two Alaskan groups, the Eye, Ear, Nose, and Throat Foundation of Alaska, and PARCA (Parents' Association for Retarded Children of Alaska), more recently formed, are actively promoting development of research, diagnostic, and treatment programs in their respective fields. The cerebral palsy program of the Alaska State Elks Association currently employs three physical therapists who cover the State by plane or mobile units, supplying services for individuals for whom travel funds to treatment centers are not available.

State and local units of the American Cancer Society, the American Heart Association, and the National Mental Health Association are helping to defray costs of treatment and travel for patients as well as conducting educational activities. Local chapters of the American National Red Cross and the National Foundation are frequently called upon in times of emergency or disaster.

Professional organizations active in Alaska include the Alaska State Medical Association, the Alaska Nurses' Association, the Alaska Dental Society, the Alaska Society of Medical Technologists, the Alaska Hospital Association, and the Alaska chapter of the National Association of Social Workers.

Many villages have organized health councils which assist materially in promoting both routine and special health activities by providing voluntary services and by raising funds.

Health and Medical Services

Medical care necessarily took precedence over preventive medicine in the early development of health services in Alaska. Medical care began with the Russian American Company, which engaged in fur trading, largely employing native workers. According to early reports, in 1866 the Russians were operating 4 hospitals, which admitted 14,550 patients during that year, "of whom only 34 died" (*4*). But for some years following the purchase of Alaska

from Russia the only medical care available was that provided by a few scattered missionaries or by military physicians attached to Army or Navy units assigned to Alaskan duty for intermittent periods.

Not until 1914 did the Federal Government establish an organized program of medical care for the Territory. This first program was under the auspices of the Bureau of Education. It was operated in conjunction with the first Territorial schools and provided treatment to natives only.

The first official step toward organization of Territorial public health activities was taken in 1913, when the first Territorial Legislature designated the Governor of Alaska to be commissioner of health. The Governor continued in this combined position until 1919, when the office of commissioner of health was created, with a physician appointed to the position on a part-time basis. The part-time commissioner and three part-time deputies constituted the entire health department until 1936, when funds became available through the Social Security Act for employment of a limited staff and establishment of a laboratory. Later, with Alaskan manpower assigned to theaters of war, and with many civilians discouraged into leaving Alaska by the Japanese landing on the Aleutians, lack of personnel reduced public health activity to emergency measures only. Since then, restoration of routine services and recruitment of personnel have been major problems.

In 1945, the Territorial Legislature gave the health department full legal status. It also established a Territorial board of health to act as an advisory body to the Alaska Department of Health, and provided for a commissioner of health on a full-time basis. The board of health was comprised of a representative of each of the four judicial divisions and the Governor.

In 1946, an extraordinary session of the legislature was called by the Governor to consider what could be done about the high rate of tuberculosis. The session resulted in the unanimous passage, by both houses, of a bill to pursue a comprehensive tuberculosis program, with an appropriation of a quarter of a million dollars. This sum was almost tripled by the next regular session of the legislature.

In the meantime, responsibility for medical care for Alaskan natives, begun by the Bureau of Education, had been transferred in 1931 to the Office (later the Bureau) of Indian Affairs in the Department of the Interior. In July 1955, these services were assigned by Congress to the Public Health Service, Division of Indian Health.

In the years immediately following World War II, health activities of both the newly created department of health and the Alaska Native Service of the Bureau of Indian Affairs were devoted mainly to control of tuberculosis. The Territorial health department sought out active cases by chest X-ray surveys, while the Alaska Native Service tried vainly to find enough beds in its five small hospitals to isolate and treat all the active cases discovered.

From the outset, each health agency necessarily carried on a combined program of medical care and preventive services in order to meet immediate situations.

Gradually, treatment and prevention are being coordinated on an overall basis. Public health nursing services, for example, in outlying areas are currently being provided entirely by the Division of Health, Alaska Department of Health and Welfare, through contractual relations with the Division of Indian Health, Public Health Service. The itinerant public health nurses of the Division of Health carry out a generalized public health nursing program which includes therapeutic as well as preventive and educational functions. Nursing personnel coordinate their activities and work closely with personnel of the Division of Indian Health hospitals.

Health and Medical Personnel

Theoretically, Alaska has 1 physician for every 1,700 persons in the population. Compared with the continental United States average of 1 physician per 800 persons, this ratio is low. The ratio of physicians serving the general population is even lower, because many physicians in Alaska occupy administrative positions or are assigned to serve only special groups, such as military personnel or Alaska Native Health Service beneficiaries.

Table 2 presents an approximate count of the physicians, nurses, and dentists currently work-

Table 2. Medical, nursing, and dental personnel in Alaska, by type of employment, 1959–60 [1]

Employer	Medical	Nursing		Dental
		Registered	Practical	
Public Health Service	39	181	77	15
Alaska Department of Health and Welfare	7	61	------	------
Private practice	117	667	124	54
Total	163	909	201	69

[1] Exclusive of military personnel. Data furnished by official agencies and State boards of medical, nursing, and dental examiners.

ing in Alaska, exclusive of those serving military personnel. Data on other health and paramedical personnel, such as medical social workers, laboratory and X-ray technicians, therapists, and so on, are less easily obtainable and counts fluctuate almost daily.

Public Health Service

Of the 39 physicians employed by the Public Health Service, 14 are stationed in Anchorage either in the Division of Indian Health area office at Anchorage or on the Public Health Service hospital staff, and 10 are located at the Mount Edgecumbe field office and hospital near Sitka. Of the remaining 15 physicians, 10 are stationed at Public Health Service field hospitals, 2 at the Fish and Wildlife Service hospitals in the Pribilof Islands, 2 at the Arctic Health Research Center in Anchorage, and 1 at the Public Health Service outpatient clinic at St. Ann's Hospital in Juneau. Of the 10 Public Health Service physicians assigned to field hospitals, 4 are at Bethel, 2 each at Kotzebue and Tanana, and 1 each at Barrow and Kanakanak.

The 15 Public Health Service dental officers are scattered. Three are at Mount Edgecumbe hospital, three at Anchorage, and one each at Barrow, Bethel, Juneau, Kanakanak, Ketchikan, Kotzebue, Nome, the Pribilof Islands, and Tanana.

There are 79 registered and 43 practical nurses assigned to the Public Health Service hospital in Anchorage, and 60 registered and 34 practical nurses at Mount Edgecumbe. Nursing staffs of the field hospitals range from 23 at Bethel, 13 registered and 10 practical nurses, to 10, 6 registered and 4 practical, at Tanana. At present, five Public Health Service nurses are assigned to the Arctic Health Research Center. One is a nurse officer assigned to the AHRC staff in Anchorage, and four are stationed at Bethel, where they coordinate their field research activities with those of the Alaska Department of Health and Welfare nurses stationed in the area. Three other Public Health Service nurses are assigned to the staff of the Alaska Department of Health and Welfare and are regarded as State employees.

In addition to medical, dental, and nursing personnel, the Public Health Service employs a number of paramedical and other personnel such as are usually associated with hospital staffs and field health service programs. The Alaska Native Health Service also conducts a School of Practical Nursing at Mount Edgecumbe, the only school for nurse education, practical or professional, in Alaska. The school is fully accredited by the National League for Nursing. It provides 12 months of instruction and training and is open only to native residents between 17 and 45 years of age. Since its establishment in 1952, the school has graduated 149 students, of whom 38 are currently employed in the State.

Public Health Service personnel at the Arctic Health Research Center include, in addition to the two physicians and five nurses, research specialists in parasitology, biochemistry, physiology, entomology, and other fields related to public health, medical, and biological research.

Alaska Department of Health and Welfare

Personnel figures for the Alaska Department of Health and Welfare are tentative only, in view of current reorganization and changes in staffing. As of May 1960, there were five full-time and two part-time physicians in the Division of Health, and two full-time and one part-time physicians in the division of mental health. No dentists are currently employed by the Alaska Department of Health and Welfare.

The 61 nurses employed by the Alaska Division of Health include 8 in administrative positions, 28 assigned to urban or community

Public health nurse on her way to make a home call

Equipment required by itinerant public health nurse on field trips

programs, and 25 stationed in outlying areas on itinerant assignments. Each nurse assigned to an itinerant service visits from 2 to 20 villages on as regular a schedule as time, weather, and travel conditions will allow. Two psychiatric nurses have recently been added to the administrative staff of the division of mental health, bringing the total number of nursing positions in the Alaska Department of Health and Welfare to 63.

Sanitary engineers and sanitarians make up the largest group of professional health personnel, other than nurses, employed by the Division of Health. Activities of the 16 sanitary engineers, 6 sanitarians, and 30 part-time sanitation aides employed under contract with the Alaska Native Health Service are outlined in a later section dealing with environmental health. The staff of the Division of Health also includes medical social workers, laboratory personnel, health educators, statisticians, and others.

Private Practitioners

Distribution of physicians and dentists in private practice and of private duty nurses in Alaska follows the usual pattern of urban concentration. Of the 117 physicians in private practice, for example, 49 are located in Anchorage and suburban Spenard, while of 42 dentists in private practice, 24 have their offices in the Anchorage area. Thus, about a third of the private medical practitioners and more than half the private dentists are concentrated in one area. Although the data on individuals in private practice in Juneau, Ketchikan, and Fairbanks are not available, table 3, which includes physicians, dentists, and nurses in government employment as well as in private practice, indicates the relative distribution of these personnel in urban areas.

Many of the physicians and dentists with urban headquarters have their own planes and frequently fly to outlying areas to provide service. A number of local specialists serve as consultants, on a contract basis, to the Alaska Native Health Service. They may provide consultation at the Anchorage or Mount Edgecumbe hospital or during special clinics scheduled at the five field hospitals.

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Table 3. Distribution of physicians, nurses, and dentists [1] in four principal Alaskan cities

City	Population [2]	Physicians	Nurses	Dentists
Anchorage	82, 560	65	262	25
Fairbanks	42, 746	14	56	5
Juneau	8, 594	8	45	6
Ketchikan	9, 842	9	28	4
Entire State	223, 888	163	1, 127	54

[1] Includes both government employees and those in private practice, exclusive of military.
[2] Preliminary census figures released by U.S. Department of Commerce, May 1960.

In both government and private employment, the turnover of professional medical and health personnel is high. Recruiting for outlying areas is frequently handicapped by lack of adequate living quarters. However, this problem is gradually being overcome as funds become available or as individual communities assume the initiative in remedying the local situation.

Medical Social Services

The medical social problems of Alaskan natives related to physical and mental illness are comparable to those which exist in other settings. In Alaska, however, they are intensified and complicated by economic, cultural, and geographic factors. Most villages are distant from medical centers, so when long-term hospitalization is necessary the patient, child or adult, is separated from the emotional and cultural support of family, friends, and community. Extended hospitalization or medical care are frequently complicated by situations such as the following: The ill spouse is replaced by another; children away from home forget their native tongue and upon their return home cannot communicate with their families; children adjust to different foods, environment, and family, if foster placement is made, and readjustment to native family, food, and home is often difficult. Because of the needs of other family members and the almost prohibitive cost of travel to and maintenance near the medical centers, parent or spouse is rarely able to accompany or to visit the patient.

With few trained social workers employed in Alaska's medical and welfare programs, and with many individuals and families in need of assistance, direct and continuous casework help can be given to a limited number only. Many persons with a wide variety of backgrounds and experience, mainly the field hospital staffs and the itinerant public health nurses, are attempting to give help to people with complicated social problems.

The number of older people in Alaska is increasing, and resources such as nursing homes and chronic disease facilities are limited and not generally available to native patients. In Alaska, as elsewhere, there seems to be a diminishing desire and sense of responsibility on the part of families and communities to care for handicapped, chronically ill, and nonproductive adults unless financial assistance is assured. Few of the crowded native homes have the space or facilities to provide this care.

Health Status

Although vital statistics for Alaska are incomplete, they still afford the best means of assessing current health conditions. Table 4 furnishes a comparison of death rates in Alaska and the United States as a whole for certain causes in 1950 and 1957 or 1958.

Because only crude, unadjusted rates are given for Alaska, the apparent low death rates from cancer, heart disease, and vascular lesions must be interpreted in light of the age distribution of the population. When age adjustments are made, the death rates, except for natives, are approximately equal to those of the 50 States.

Changes in infant and maternal death rates are generally regarded as significant measures of public health and medical progress. In Alaska, although health services are improving, the infant death rate among the native population in 1958 was still almost three times that for the United States (table 5). Among nonnative Alaskans, most of whom have readier access to medical facilities, the 1958 infant death rate was slightly above that for the United States.

The apparent increase in the death rate due to diseases of early infancy shown in table 4 actually reflects only the high birth rates resulting from the large proportion of young adults of childbearing age in the population. The

Table 4. Comparative death rates [1] by important causes and race, Alaska, 1950 and 1958,[2] and United States, 1950 and 1957

Cause of death	Alaska						United States	
	All races		White		Native			
	1950	1958	1950	1958	1950	1958	1950	1957
All causes	926.3	610.3	666.7	509.2	1,693.2	1,036.8	963.8	959.0
Tuberculosis	174.5	12.0	15.8	5.4	654.9	39.5	22.5	7.8
Other infectious diseases	30.7	10.8	8.9	5.3	97.3	34.2	11.7	----
Influenza and pneumonia	56.2	35.4	13.8	20.4	182.9	100.0	31.3	35.8
Other respiratory diseases	9.5	21.0	4.0	13.8	26.5	52.6	8.9	----
Maternal	6.6	1.0	2.0	----	20.6	5.3	2.0	1.0
Congenital malformations	10.2	21.0	6.9	20.4	17.7	26.3	12.2	12.8
Diseases of early infancy	44.5	76.4	34.6	61.2	76.7	139.5	40.5	39.1
Ill-defined	34.3	24.1	20.8	7.9	76.7	89.5	14.9	11.3
Accidents	153.3	115.9	132.5	100.0	218.3	181.6	60.6	56.0
Suicides	24.1	14.4	25.7	14.5	20.6	13.2	11.4	9.8
Homicides	12.4	10.3	10.9	7.9	8.8	15.8	5.3	4.5
Alcoholism	8.0	8.7	7.9	6.6	8.8	18.4	1.5	1.3
Cancer	65.7	49.2	72.2	48.0	44.2	57.9	139.8	148.7
Vascular lesions	47.4	33.3	53.4	31.6	29.5	39.5	104.0	110.2
Heart	167.2	113.8	193.9	120.4	82.6	92.1	355.5	369.1
All other causes	81.7	62.9	63.4	46.1	127.1	131.6	141.7	----

[1] All rates per 100,000 estimated population.
[2] Data residence corrected.

SOURCE: U.S. data from National Office of Vital Statistics, Public Health Service. Alaska data from Bureau of Vital Statistics, Alaska Department of Health and Welfare.

rates given in table 5, showing deaths of infants under 1 year of age per 1,000 live births are a more realistic indicator of natal and postnatal conditions.

From these tables, it is evident that mortality rates in Alaska have improved in recent years. The greatest gain has occurred in control of communicable and infectious diseases, particularly tuberculosis.

Of major concern in Alaska is the increasing number of violent and accidental deaths (table 6). Alaskan death rates from accidents, homicides, and alcoholism are double those for the Nation as a whole. Despite improvement in the past few years, the rates remain high. For several years, accidents have been a leading cause of death among the native population (table 4).

The unusual reliance on air travel in Alaska plus the presence of several large air bases is one considerable factor in the high accident rate. Although the commercial and "bush" air-

Table 5. Infant and maternal death rates in Alaska, 1950, 1956, and 1958, and in the United States, 1950, 1956, and 1957, by race

Type of rate and year	Alaska			United States
	All races	White	Native	
Infant death rate: [1]				
1950	50.5	23.8	95.3	29.2
1956	41.2	25.3	88.7	26.0
1957	(2)	(2)	(2)	26.3
1958	39.0	27.9	70.0	(2)
Maternal death rate: [3]				
1950	24.3	8.7	50.9	8.3
1956	6.6	3.7	10.5	4.1
1957	(2)	(2)	(2)	4.1
1958	5.7	2.1	10.3	(2)

[1] Per 1,000 live births.
[2] Not available.
[3] Per 10,000 live births.

SOURCE: Alaska data from Bureau of Vital Statistics, Alaska Department of Health and Welfare; U.S. data from National Office of Vital Statistics, Public Health Service.

Table 6. Deaths from selected accidental causes, for all races, Alaska, 1954–58

Cause of accident	Number	Percent
All accidents	1,299	100.0
Transport accidents	661	50.9
Railway, plus other road vehicles	2	.2
Motor vehicle	169	13.0
Water transport:		
Drowning	158	12.2
Other	26	2.0
Aircraft [1]	306	23.5
Nontransport accidents	638	49.1
Poisoning	39	3.0
Falls	53	4.1
Fire	115	8.8
Firearms	55	4.2
Drowning, nontransport	131	10.1
Excessive cold	19	1.5
Other	226	17.4

[1] Predominantly military and noncommercial.

SOURCE: Bureau of Vital Statistics, Alaska Department of Health and Welfare, January 8, 1960.

line safety records in Alaska are excellent, accidents involving planes operated for the sole use of the owner have boosted the mortality rate from transportation accidents to top position. Rates for deaths from drowning and from fires are also high, especially among the native population. Even the number of deaths from motor vehicle accidents is relatively high in Alaska in spite of its limited highways.

Assessing Alaska's morbidity rates is risky. Information available on incidence of communicable and other diseases is incomplete and often inaccurate, and can be misleading. While it can be stated with some accuracy that there have been no recent decimating epidemics of childhood diseases among the native population, such as have occurred in past years, the true incidence of disease is unknown. Most of the difficulty in obtaining accurate information on morbidity stems from the lack of medical facilities and personnel. Cases of disease in outlying villages may be missed entirely or may be inaccurately reported by untrained observers.

The situation is gradually improving as better communications are established and as funds become available for assigning trained personnel to the field. Education has also played a major role in improving the reporting of disease outbreaks and in obtaining prompt medical attention when needed. Village teachers and missionaries have effectively supplemented the efforts of health personnel in helping villagers to learn about and to accept sanitation and other health practices.

A continuing handicap to accurate diagnosis and reporting of disease in remote areas is the difficulty of obtaining laboratory specimens for confirmation within a reasonable time after the onset of illness.

Diagnostic laboratories, other than those located in the major population centers, are few and far between. The process of collecting and delivering specimens to the laboratory is complicated by travel delays which may cause cultures to die or to freeze en route. The cost of laboratory services is not inconsiderable in Alaska. In 1958 the average cost of these services in the Alaska Division of Health laboratories was $1.47 per specimen, or 52.6 cents per capita, about three times greater than in many smaller, more densely populated States.

Tuberculosis

Tuberculosis has been Alaska's number one health problem for well over a century, according to historical reports. There is no evidence that tuberculosis existed among Alaskan natives prior to the arrival of the white man, but once introduced, the disease apparently spread rapidly. The first reference to the occurrence of tuberculosis among the native peoples of Alaska, according to Aronson (*5*), appeared in 1770, some 29 years after the discovery of Alaska. But by 1814, tuberculosis was reported as one of the most common diseases among the natives. From that time on references to the large numbers of cases of and deaths from tuberculosis are frequent.

A 5-year study of the causes of death in Alaska, 1926–30, revealed that the tuberculosis death rate among Alaskan natives during that period was 655 per 100,000 population (*6*). The very first issue of *Alaska's Health* (*7*) the official publication of the Division of Health, contains the following statements:

". . . tuberculosis is 10 times as prevalent in Alaska as in the northern States and far surpasses all our communicable disease problems together as a direct cause of death."

". . . tuberculosis is causing more servicemen

to be sent back to the States from Alaska than from any other outpost of the war."

"Large numbers of natives are unsuited to military service because of tuberculosis."

"Nearly 90 percent of routine X-rays among natives in the Arctic indicate the presence of tuberculosis."

In 1950, the tuberculosis death rate among Alaskan Eskimos and Indians was still an appalling 654.9 per 100,000. But between 1950 and 1957 a remarkable change occurred, and by 1957 the tuberculosis mortality rate among natives had been reduced to 116.2 per 100,000 (table 7). Provisional rates for 1959 show a further reduction to 53.8 per 100,000 in the native population.

The story behind this dramatic reduction in tuberculosis deaths began in 1946, during a special session of the Territorial Legislature, called by the Governor at the behest of the Territorial department of health and the board of health. There were, at the time, 4,000 known active cases of tuberculosis in Alaska, with about 75 hospital beds available for tuberculosis patients in the entire Territory.

Beginning with this special session, in the next few years Alaska's Legislature appropriated more funds per capita for tuberculosis control than any State legislature in the Nation. These Territorial funds, plus generous contributions of Federal funds made available by Congress beginning in 1948, accelerated control of tuberculosis within the next decade to the point where Alaska can now care for all its tuberculosis patients within its own borders. This in itself has been a major achievement.

In spite of the tremendous gains in the past 14 years, tuberculosis is still a major health problem demanding continued effort and vigilance. During 1959, there were 356 newly reported active and probably active cases, representing a rate of 178.0 cases per 100,000 total population. As in past years, the preponderance of cases (766.6 per 100,000) was found in the native population (*8*).

Although the methods employed in the 1950–57 Alaska campaign against tuberculosis were the same procedures used elsewhere, that is, casefinding, hospitalization, chemotherapy, rehabilitation, education, and followup, their application in Alaska demanded drastic modification and ingenuity.

Generally in the 48 States, the highest incidence of tuberculosis has been found in urban areas. In Alaska, the highest incidence occurs in the small Eskimo, Indian, and Aleut villages, particularly those located in the Kuskokwim and Yukon River deltas. As in urban slum areas in continental United States, the economic status in these villages is marginal, many of the homes are crowded and poorly ventilated, and most of them lack sanitary facilities. Nutrition is poor and resistance to disease is generally low.

Table 7. Tuberculosis deaths, all forms, and death rates,[1] by race, Alaska, 1950–59

Year	Total		White [2]		Native [2]	
	Number	Rate	Number	Rate	Number	Rate
1950	239	174. 5	16	15. 8	222	654. 9
1951	239	148. 4	13	10. 5	223	655. 9
1952	191	100. 0	19	12. 4	171	500. 7
1953	130	63. 4	10	6. 0	120	349. 8
1954	97	46. 7	14	8. 3	82	236. 6
1955	54	25. 8	8	4. 7	45	128. 6
1956	50	24. 3	9	5. 5	41	114. 0
1957	56	26. 5	13	7. 7	43	116. 2
1958	23	12. 0	8	5. 4	15	39. 5
1959 [3]	24	12. 0	3	1. 9	21	53. 8

[1] Per 100,000 population.

[2] Figures for whites and natives do not necessarily add to total, which may include certain other races not shown in detail here.

[3] Provisional figures.

SOURCE: Alaska Department of Health and Welfare.

Village of Atka far out toward the tip of the Aleutian Islands Chain (beyond area shown on map)

Tuberculosis casefinding in the early days of the Alaskan campaign was limited to the field hospitals and a single Territorial department of health mobile X-ray unit which traveled from village to village by whatever mode of transportation was available, as time, weather, and funds permitted. Developing the exposed film often had to be delayed for weeks until the technician reached a hospital equipped for film processing. In early 1945, a motorship, the *Hygiene*, was put into operation as a floating X-ray and clinic unit, visiting communities along the southeastern coast.

When the organized campaign against tuberculosis was begun, official and voluntary agencies combined their resources to put additional X-ray facilities into operation. Two additional marine units were equipped to extend health services to northern coastal and inland river villages. A railroad car, furnished by the Alaska Railroad, was outfitted to serve railbelt communities, and a motor truck unit was provided for surveying communities along the Alaska Highway and the limited access roads. Airborne units were also used to reach the many communities accessible only by air.

As air travel improved, the various mobile surface units were gradually withdrawn from service, and from 1957 on, most of the X-ray activities have been performed by three airborne units. Each unit is equipped with a portable X-ray machine, darkroom tent, and gasoline generator, and each is manned by a technician. Two of the units are supported by the Public Health Service Division of Indian Health, the third by the Alaska Division of Health.

Of 37,695 chest X-rays taken in 1959, almost two-thirds were taken by the three airborne units. The remaining X-rays were taken by health centers, Alaska Native Health Service hospitals, general hospitals, the U.S. Coast Guard, and the Alaska National Guard.

Laboratory work relating to tuberculosis control constitutes a major item in the work schedules of the four Alaska Division of Health laboratories. During 1959, a total of 22,868 tuberculosis smears and cultures were processed in

the four laboratories. Over 15,000 individuals were tuberculin tested in 1959 in connection with casefinding or followup activities, the majority on request of physicians.

Facilities in Alaska are adequate today for treating all tuberculosis cases requiring hospitalization. The 75 tuberculosis beds available in 1946 had been increased by 1953 to 796, chiefly by the opening of the Alaska Native Service hospitals at Mount Edgecumbe and Anchorage. Even with this tenfold increase, however, the number of available beds still fell far short of meeting the need.

In 1955, additional beds were made available on a contract basis at hospitals and sanatoriums in the State of Washington. On December 31, 1955, the total number of Alaskan patients hospitalized for tuberculosis within and outside Alaska was 1,311. By December 31, 1958, the number had dropped to 444, all hospitalized within Alaska. This drop represents a significant gain, inasmuch as by 1958 the requirements for hospital admission had been considerably relaxed, and patients who would not have been considered in 1955 were now being admitted.

Only 6 years ago, the waiting period for tuberculosis hospitalization often defeated the casefinding program. Take the hypothetical, but typical, case of Wassillie Niptuk, 40-year-old Eskimo from Iliamna. Wassillie received his chest X-ray in August 1954. When the film was developed and read a month later, the need for hospitalization was indicated. His name was put on the priority board list in January 1955, but a hospital bed did not become available until October of that year. When the hospital tried to contact Wassillie to arrange for hospitalization, the public health nurse reported Wassillie had died the previous week.

Public health and medical personnel in Alaska are particularly proud of the fact that few Alaskan tuberculosis patients leave the hospital against medical advice. Of 480 hospital discharges in 1959, only 12 were against medical advice. In the 48 States, more than 30 percent of the annual discharges have usually been against medical advice (*9*).

Late in 1954, when many tuberculosis patients had to wait months for hospitalization, a home treatment program based on the use of drugs and antibiotics was initiated among native patients in their home villages. The initial objective of the ambulatory chemotherapy program was to determine whether a scheme of administering isoniazid (INH) and para-aminosalycylic acid (PAS) on an ambulatory basis over a long time with, at best, only intermittent supervision was a practicable procedure in Alaska. The program, financially supported by the Public Health Service, was inaugurated in December 1954 under the direction of the Arctic Health Research Center in cooperation with the Territorial department of health and the Alaska Native Service.

During the next 1½ years, the chemotherapy program was extended to 70 native villages in northern, western, interior, and south-central Alaska, where tuberculosis was especially prevalent. By mid-1956, when some 1,600 patients were participating, the program had been widely accepted and was deemed practical and became a continuing phase of the treatment for tuberculosis. In September 1956, the Territorial health department assumed responsibility for continuing chemotherapy in native villages in all of Alaska save the Bethel area where the Arctic Health Research Center retained responsibility for the program.

Patients were started on chemotherapy on recommendation by physician members of a priority board, primarily on the basis of X-ray evidence or positive sputum reports, or both. In general, tuberculosis patients who were started on chemotherapy included those awaiting hospitalization, those returning from the hospital, and patients who, because of shortage of hospital beds, could not be admitted at the time hospitalization was recommended.

Recommendations of the priority board were given to medical officers in the Alaska Native Health Service field hospitals, who issued orders for therapy to teams of field nurses. The nurses were directly responsible for bringing the program to the villagers, eliciting cooperation of patients, supervising administration of the drugs, explaining the program, and evaluating the response. In each village, the nurse was assisted by a native chemotherapy aide, usually selected by the village council for training by the nurse.

The success of the chemotherapy program testifies to the effectiveness of the concerted efforts of all individuals and agencies concerned. Of particular importance were the close working relationships which developed among governmental agencies; the cooperation and assistance given by the village teachers; the willing participation and cooperation of the Eskimos and Indians, who were only too well aware of the specter of tuberculosis; and above all, the dedicated efforts of the nurses, who were directly responsible for explaining the program and insuring its acceptance.

The precise contribution of the ambulatory chemotherapy program to the tuberculosis control program cannot be determined. There is little question, however, that initiation of home treatment during the period of waiting for hospitalization, together with drug therapy during hospitalization, radically shortened the length of stay in the hospital, thus making beds available to more patients.

In the Bethel area, the number of village patients on home treatment fell from nearly 1,100 persons, 18 percent of the population in participating villages, in September 1956, to 400 persons at the end of 1958. By 1957, the characteristics of the population on home treatment had shifted completely. Instead of a preponderance of patients awaiting hospitalization, the majority were posthospital cases. The tide of tuberculosis had turned.

Even while the need for effective treatment still seemed desperate, hopes were raised for a means of preventing tuberculosis infection. A tightly controlled study of the effectiveness of INH in tuberculosis prevention was initiated in southwestern Alaska late in 1957 by the Public Health Service Tuberculosis Program and the Arctic Health Research Center in conjunction with the Alaska Native Health Service. Some 5,000 persons, 80 percent of the total population, in 24 villages were put on daily medication for 1 year. Although results of this study will not be known for several years, it is anticipated that this trial, in combination with other trials in the rest of the country, will demonstrate whether or not the administration of isoniazid will prevent the development of tuberculosis or the relapse of tuberculosis patients.

Other Diseases

For lack of data on diseases other than tuberculosis in Alaska, estimates of current morbidity are, of necessity, based largely on clinical observation, supplemented by a few morbidity studies.

For many years the Alaska Division of Health has compiled reports of notifiable diseases from data submitted by the health centers in the larger communities, weekly laboratory reports, and intermittent postal card reports from individual physicians. According to a 20-year summary based on these reports, the "top 10" diseases in order of numbers of cases reported were: influenza and pneumonia, measles (including German measles), tuberculosis, chickenpox, gonorrhea, mumps, impetigo, syphilis, streptococcal sore throat, and whooping cough.

A limited morbidity study conducted in the Anchorage area in 1952 indicated that the pattern of illness in that area differed little from that found in cities of similar size in continental United States. Respiratory illnesses led the list in both instances but with fewer days of disability in Anchorage than elsewhere. Detailed morbidity studies are currently underway in the field.

Early attempts to assess morbidity by hospital admissions throughout Alaska met with little success, because of the lack of medical records. In many instances, the admitting physician was frequently the only individual who knew why the patient was in the hospital. In the early years, records from the Alaska Native Service hospitals invariably listed tuberculosis as the sole reason for hospitalization.

As indicated earlier, the data on death rates from heart disease, cancer, and other diseases associated with aging are misleading because of Alaska's predominantly young population. A study of heart disease among Alaskan Eskimos and Indians is now underway, and results of this study may alter the general impression that native groups are not subject to the same stresses and strains as the white population.

Progress toward control of communicable disease in Alaska is uneven. The problems of the larger communities are essentially the same as those found in all urban areas where pop-

ulation growth outstrips the planning and development of adequate sanitary facilities and health services. In view of the frontier character of even the larger Alaskan cities, it is remarkable that there have been no major outbreaks of communicable disease. As for the villages, although epidemics of mumps, measles, and other so-called childhood diseases occur from time to time, their effects are far less devastating than in former years, thanks to the vigorous immunization and education programs carried on by the Alaska Division of Health and the hospitals of the Public Health Service Division of Indian Health. Improvements in home and village sanitation, slow as they are, are real. Many tuberculosis patients returning to their villages from the hospital have contributed to these improvements by encouraging other ill persons to seek treatment and by demonstrating improved housekeeping and personal practices learned in the hospital.

Enteric infections are known to be common in Alaska, particularly rural Alaska, although their incidence is not on record. Itinerant public health nurses and individual investigators report that enteric upsets occur so frequently in villages that they are regarded by the people as normal events and are seldom reported. Those upsets which are reported are rarely confirmed by laboratory or clinical methods, for reasons cited earlier.

Field and laboratory studies have turned up relatively few bacterial pathogens in connection with outbreaks of enteric disease. Only 625 cases of salmonellosis, paratyphoid fever, and typhoid fever were reported in Alaska between 1937 and 1957. During the same period, 576 cases of enteric disease were reported as gastroenteritis and 682 as diarrheal infections. *Salmonella typhimurium*, *Salmonella typhosa*, *Shigella flexneri*, and *Shigella sonnei* are the species most often isolated in the laboratory.

The incidence of enteric infection is higher in summer than in winter, increases with the spring breakup, and continues sporadically until freezeup. Although the exact modes of transmission of organisms are not known, the number of long-drawn-out household epidemics implicates poor food handling, contaminated water supply, and overcrowded dwellings. Indirect transmission of infection through contamination of the surroundings by dogs, which abound in each village, has been demonstrated for *Salmonella typhosa*. Intensive short-term studies of intestinal parasitism have shown a high prevalence in some areas of parasitic infestation, notably fish tapeworm. A 30 percent infection rate has been reported in single villages (*10*).

Blood sugar determinations performed on 1,227 Eskimos, plus review of clinical records of Alaska Native Health Service hospitals and available vital statistics reports, have uncovered only 3 confirmed and 2 doubtful cases of diabetes mellitus among the 16,000 Eskimos living in Alaska (*11*). Although age distribution and lack of diagnostic facilities no doubt account in part for the infrequency of diabetes, nutrition and racial characteristics may be factors. Possibly an increase in the number of cases of diabetes may be expected as the transition from native to imported foods continues.

A moderate form of anemia has been found to occur in Eskimos over much of Alaska (*12*). Results of detailed investigations and experimental studies of the effects of iron therapy suggest that iron deficiency and some other factor, as yet undetermined, are associated with the condition. Also, dietary studies and clinical observations indicate that iron intake among Eskimos is below allowances recommended by the National Research Council. The possibility that low hemoglobin levels might be associated with fish tapeworm infestation was investigated, but no apparent relationship could be demonstrated.

Corneal scarring with resultant loss of visual acuity has long been considered a major affliction of Eskimos and Indians. Various causes for this eye condition have been explored by investigators in past years, but no completely satisfactory explanation has been established. Tuberculosis, nutritional deficiencies, snow blindness, and indifferent personal hygiene have all been suggested. Tuberculosis is generally given most of the blame, although it is not invariably associated with phlyctenular keratoconjunctivitis (PKC).

A preliminary survey to determine prevalence of corneal scarring, the first step in an epidemiological study of PKC, showed that 41 percent of 6,000 persons examined had corneal

scars, with varying degrees of visual impairment.

Animal-borne diseases, such as trichinosis, rabies, and echinococcosis or hydatid disease, are known to occur in Alaska in somewhat different patterns than are found elsewhere. For example, trichinosis occurs in walrus, in black, grizzly, and polar bears, and in a number of other flesh-eating animals on which the natives depend for meat. In one survey, 27 percent of the residents of one coastal village showed positive reaction to skin tests for trichinosis. As pork production is extremely limited in Alaska, most human cases of trichinosis here are attributed to undercooked bear meat.

Rabies is endemic among wild animals in Alaska, and it is generally believed that the large fox population serves as a reservoir for the disease. Despite frequent reports of dog bites, only three clinical cases of human rabies have been reported. None was confirmed by laboratory examination. In view of the large dog population in Alaska and the close association of these animals with villagers, the low case rate of human rabies is puzzling. Three possible explanations have been advanced: (*a*) that the dog team owner, thoroughly familiar with the behavior of rabid foxes, wolves, and dogs, is quick to destroy any animals exhibiting typical symptoms; (*b*) that the heavy fur, wool, and skin clothing worn by both children and adults provides effective protection against bites; and (*c*) that the type of rabies endemic in Alaska is less virulent than the types found elsewhere. Special studies of the last theory are underway.

A number of cases of the cystic form of hydatid disease, caused by *Echinococcus granulosus*, have been found in Alaska since this form of the disease was first recognized in 1948. Surgical removal of the cysts, which are usually found in the lungs, has been accomplished with good prognosis.

The occurrence of a second form of echinococcosis in Alaska was first recognized in 1952 in the course of investigations underway at the Arctic Health Research Center. This second or alveolar form of hydatid disease, caused by *Echinococcus multilocularis*, presents a much more serious aspect than cystic echinococcosis. Nine human cases of this form of the disease have been discovered in Alaska in the last few years. The liver is the most common site of this infection, and early diagnosis is extremely difficult. Generally, by the time the disease is recognizable in man it is inoperable.

Alaskan investigators are working in close collaboration with laboratories in other parts of the United States and with European investigators in an attempt to find effective diagnostic methods which will permit earlier detection and treatment of alveolar hydatid disease. The life cycle of *E. multilocularis* in Alaska has been found to include voles and arctic foxes. Dogs frequently become involved and man becomes infected accidently. The infection is transmitted by fecal contamination, but the exact details of transmission are not known.

Dental Health

The general impression has been that Alaskans, as a group, have poor teeth. Examinations of Eskimo and Indian patients at Public Health Service hospitals and during infrequent field visits have confirmed this impression. Little information is available concerning the dental health of the white adult civilian population, aside from the fact that dentists in private practice in Alaska are extremely busy.

According to two 1955 dental surveys conducted by the Public Health Service, school-age children in the Anchorage area showed a lower rate of tooth decay than did children in the same age groups in Tacoma, Wash. By contrast, 1952 statistical estimates of the amount of tooth decay among Eskimo children at Barrow and among Indian children at Ketchikan indicated the highest decay rates reported anywhere in the United States and its possessions. Observers also find that the more isolated the village, the smaller the number of decayed teeth. In such villages there tends to be a high proportion of protein and fat in the diet and relatively little carbohydrate.

Expansion of Public Health Service dental health services among Eskimo and Indian residents has presumably reduced the backlog of acute dental needs to some extent, but the field of preventive dentistry has hardly been touched.

Eskimo woman sewing on parka. Eskimo women are artists at skin and fur sewing and make boots (mukluks) and parkas for themselves and their families. Use of their teeth in "crimping" the mukluk soles can lead to a dental problem.

At the present time, Anchorage is the only Alaskan community fluoridating its water supply; however, this particular supply serves only about one-fourth of the total population of the Anchorage area. Since the majority of Alaska's population is still dependent on individual wells or other private sources of supply, the benefits of fluoridation are not likely to be made available on a large scale for some time.

Questionnaires on the subject of health services distributed to village chiefs and officials brought the following replies (*13*): "No dentist ever been here." "No dentist stop here for 10 years." "When dentist comes only has time for extractions."

The dental care situation among non-native civilians living outside the few metropolitan areas has not improved. Of the 54 dentists in Alaska, 40 are located in the 4 largest cities. Emergency patients from outlying communities must travel to the nearest urban area, hoping that one of the dentists will squeeze him in on his crowded schedule. All too often the patient discovers that multiple treatments are needed, and his dental bill is increased by the expense of board and room and travel.

Maternal and Child Health

For many years, health services for children in Alaska were overwhelmed by the number of acute orthopedic deformities caused by tuberculosis of bones and joints. Shortly after the orthopedic section of the Mount Edgecumbe hospital opened in 1946, it was believed to have more patients with bone tuberculosis under its roof than any other one spot in North America. As recently as 1955, bone tuberculosis was found frequently among Eskimo and Indian children by traveling orthopedic clinics during annual circuits. Happily, progress in control of extrapulmonary as well as pulmonary tuberculosis has been such that bone tuberculosis today is almost as rare in Alaska as in other States.

At present, upper respiratory infection is responsible for more disability in Alaskan children than any other single disease entity. Chronically draining ears and chronic mastoiditis, with varying degrees of hearing loss, are highly prevalent. Estimates based on surveys by competent otologists indicate that as many as 3,000 children in Alaska require radical mastoidectomies before their chronic infections can be cleared up.

The number of children requiring extensive surgical treatment and the expense of transporting patients for treatment have spurred attempts to find means of reducing complications from respiratory disease. A special study was undertaken in 1957–58 to see if an intensive program of prevention would be effective. Six villages along the lower Yukon and lower Kus-

kokwim Rivers in western Alaska were known to have exceptionally high rates of chronic ear, nose, and throat infections. A team consisting of a physician, two public health nurses, and a health educator was sent to these villages by the Alaska Division of Health. The health educator was assigned to study the attitudes of the villagers and, if possible, find ways of encouraging them to improve health practices. The two nurses supported the medical and educational services by following up special cases through home visits. Consultation services were available from personnel of the Division of Health and other agencies. Nose, throat, and other specimens were collected periodically and forwarded to the Epidemiology Section of the Arctic Health Research Center for culture and study. The accumulated laboratory findings and field data are now being analyzed.

More than 1,500 handicapped or injured Alaskan children received diagnosis, treatment, or hospitalization through the Division of Health during 1959. Under the program operated by the crippled children's services section of the Division of Health and financed by State and Federal funds, services are provided for orthopedic, plastic, eye, ear, nose, and throat, and chronic disease cases.

A total of 1,518 children received diagnosis or treatment for 41 different crippling conditions (*14*), including the following:

Condition	*Cases*
Tuberculosis of bones and joints	76
Aftereffects of poliomyelitis	43
Cerebral palsy	35
Eye conditions (ranging from simple corrections to surgery)	411
Deafness and hearing impairment	146
Heart conditions, including heart surgery	135
Congenital malformations	226
Severe burn cases, requiring long hospitalization and care	6

During the year 128 children were hospitalized a total of 1,074 days, or the equivalent of nearly 3 years. Children requiring complicated treatment for such conditions as cleft lip and palate and for severe burns are sent to Seattle for treatment. Children with congenital heart disease are sent to San Francisco for specialized diagnostic workups and for heart surgery, including the new open heart surgery.

Transportation costs constitute a large item in the child health program. Between July 1 and December 31, 1958, for example, transportation costs accounted for 20 percent of the total cost of the services provided.

This financial strain has been eased materially by the Alaska Native Health Service and by voluntary groups, notably the Alaska Crippled Children's Association and the Alaska Tuberculosis Association. State, Federal, and voluntary agencies have also cooperated in bringing specialists to Alaska for diagnostic clinics, consultation, and training sessions.

Mental Health

Responsibility for management of its own mental health problems was transferred to Alaska from the Department of the Interior as recently as 1956. In passing the Alaska Mental Health Act that year, Congress also gave Alaska the right to select 1 million acres of public lands within its borders to be used as a source of income for support of mental health services.

Hospitalization for most of Alaska's mental patients is still provided through contractual arrangements with Morningside Hospital, a private institution in Portland, Oreg., as it was under the Department of the Interior. Total cost of the Morningside program in 1958 amounted to $1,100,000, including $44,000 for transportation of patients and escorts. Seventy-nine Alaskan patients were admitted to Morningside Hospital during 1958, with a total of 404 Alaskan patients on the hospital records as of December 31, 1958.

The diagnostic classification of the 79 patients admitted to Morningside during 1958 was:

Diagnosis	*Percent*
Psychotic disorders	45.5
Chronic brain syndrome	21.5
Mental deficiency	17.5
Psychoneurotic disorders	7.5
Personality disorders	3.7
Transient situational disorders	1.3
Undiagnosed	3.0

Alaska has begun to develop an integrated program of mental health activities, including diagnostic, preventive, and educational services. Under the direction of the division of mental health of the State department of health

and welfare, studies have been made of Alaskan patients admitted to Morningside Hospital during recent years to determine their distribution by age, sex, and race as well as by diagnosis.

One of the most significant findings is the marked increase between 1948 and 1958 in the number of admissions among patients in the younger age groups. Comparison of data on admissions for the two 5-year periods, 1949–53 and 1954–58, shows a 68 percent increase in the admission of patients under 6 years of age during the period 1954–58 and a 46 percent increase among the 6- to 10-year-olds during the same period. These increases may be attributable in part to the practice of sending mental defectives to Morningside for lack of any alternative facility in Alaska. However, a significant proportion of the increase is undoubtedly due to disturbances among young people which presumably might have been detected earlier and treated locally had community facilities been available.

During 1958, mental health outpatient clinics were provided for southeastern Alaska through the Juneau office, and for the south-central region through the Anchorage office. Thus far, only consultative services have been possible for the northern region. Personnel of the mental health division travel as teams to communities outside the urban areas. In the 12 months ending June 30, 1958, the clinic personnel and traveling teams saw 419 patients and conducted 1,527 interviews.

Of the 419 outpatients seen, 233 were male, 186 were female; 270 were under 18 years of age and 149 were over 18. Patient referrals came from the Alaska Native Health Service, the Alaska Department of Health (for the most part from public health nurses), the Office of Vocational Rehabilitation, public schools, police officials, Federal courts, U.S. commissioners, the Alaska Department of Welfare bureau of juvenile institutions, private physicians, and other sources.

Since 1957, voluntary admission to Morningside Hospital has been permissible and jury trials are no longer required, although the protection of a court hearing has been retained for those who desire it. In 1958, of the 79 admissions, 39 were voluntary, 22 were judicial, and 13, certified by a physician, were involuntary. The remaining five included one transfer and four patients returned from convalescent leaves.

Of the cases closed during 1957, nearly half bore the notation "further care indicated," but the needed clinic services or community resources were not available.

Environmental Health

Alaska's environmental health needs include both the familiar and the unique. In Ketchikan, Juneau, Anchorage, and other urban communities located in the more temperate southern and central portions of Alaska, the tasks confronting the sanitary engineer do not differ markedly from those found in many cities of comparable size in continental United States. On the west coast and in interior and northern Alaska, the tasks are complicated by permafrost, extremes of temperature, and the character of the small, widely dispersed communities.

Throughout Alaska, unique political, economic, and social structures require "custom tailoring" of services, which tax the ingenuity of environmental health personnel. Only in the north is a sanitary engineer called upon to collaborate in developing a manual for the handling and tethering of sled dogs or to demonstrate how to drill a well through several hundred feet of permafrost.

Sanitation services in Alaska are currently provided for both the State as a whole and for more than 300 individual communities by a staff of 22 engineers and sanitarians in the department of health and welfare; by a lone sanitary engineer in the area office of the Alaska Native Health Service; and by 30 part-time sanitation aides who are employed through contractual arrangements between the State Division of Health and the Alaska Native Health Service.

The professional staff of the Division of Health carries on educational, consultative, supervisory, and inspection services and administers statewide programs involving industrial health, water pollution control, radiological health, and safeguarding of foods, drugs, and cosmetics. The Alaska Native Health Service sanitary engineer is charged with the responsibility of inspecting sanitary facilities at all the Public Health Service hospitals and at Bureau of Indian Affairs boarding and day schools throughout Alaska.

Waste disposal beside frame house

In the outlying villages, the efforts of the staffs of the two official agencies are reinforced by part-time Eskimo and Indian sanitation aides. The aides, selected by joint agreement of the village council and health agency representatives, receive brief but intensive training in basic sanitation through courses planned and administered by the Division of Health in consultation with personnel of the Alaska Department of Health and Welfare, Alaska Native Health Service, and Arctic Health Research Center. Activities of the aides in their assigned villages are supervised and reviewed periodically by the same agencies.

Adaptation of water supply, waste disposal, housing, and food-handling methods to Alaskan needs requires careful observation and research. As temperature drops, operation and effectiveness of many of the standard sanitation devices and practices are impaired unless countermeasures are applied. Chemical and biological reactions are generally retarded at low temperatures, and the physical properties of materials are often changed.

The Alaska Division of Health cooperates closely with designing engineers, architects, public agencies, the Arctic Health Research Center, and other groups in developing and promoting needed modifications of standard devices. A recirculating water system installed at Fairbanks, largely as the result of the joint effort of the Alaska Division of Health and the Arctic Health Research Center, has been called the most ingenious water system in North America. The farthest north sewage stabilization pond, now in operation at Fort Yukon, is another example of such a joint effort by these two agencies. Basic data on coastal and inland waters and their ability to assimilate wastes are also being accumulated. Experimental closed-circuit toilet units have been installed at various locations through interagency cooperation. These are being observed as a possible waste disposal method for isolated dwellings and small settlements where conventional systems are impractical because of extremes of temperature, scarcity of water, or presence of permafrost, separately or in combination. Coordination of planning and joint financing of projects among the three official health agencies is slowly but surely paying dividends in improvements in community sanitation.

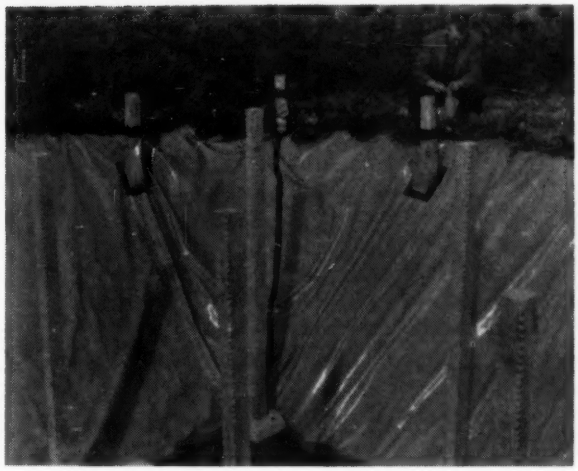
Many of Alaska's environmental sanitation problems could be solved were adequate money available. Per capita incomes in the small communities are invariably too low to finance utilities even of the most simple variety. The Indian Sanitation Facilities Bill, which became Public Law 86–121 in July 1959, offers some assistance to the small native villages in developing community water supplies and in improving home and village waste disposal facilities through cooperative projects. The number of requests for such projects already received testifies to the great interest in the program. Many villagers have indicated their awareness of need for improvements and their eagerness and willingness to contribute local materials and labor as their share in the projects.

Education and demonstration play an essential part in village improvements. Without community acceptance and understanding of sanitary methods and facilities, improvements are worthless. Constant supervision in each community is obviously impossible in an itinerant program, where even the part-time sanitation aide may be given responsibility for more than one village. Emphasis is placed therefore on the need for careful explanations, which must often be given through an interpreter, to develop complete understanding within limits of the educational levels of the residents. Evidence of the achievement in education is seen in changed practices and atti-

Water supply is a problem in the Arctic. Cans are used to dip water through holes in the ice on lakes or rivers. Sanitarians and public health nurses stress boiling or chlorine treatment of water for household use.

tudes observed among residents in the various villages and in the increasing number of requests for advice and assistance received by all health agencies.

Well jetting through permafrost, Eek



Experimental water supply reservoir, Goose Lake

Housing

Health and population gains in native villages and rising standards of living are intensifying demands for better housing in many communities. Experimental houses, based on designs specifically adapted to climatic conditions which exist in different parts of Alaska, have been constructed in several villages as demonstration units. A scale model of each experimental unit was built and taken to the village so that local residents could follow construction details and participate in the building program. As each unit is completed, a local family, selected jointly by the village council and health agency representatives, occupies the dwelling rent free for a trial period, during

Water storage barrel outside house

Models of experimental houses designed by Arctic Health Research Center for construction in native villages. Designs, construction methods, and materials are adapted to varying environmental conditions and needs of individual villages.

which records of fuel consumption, temperature and humidity levels, and other data are kept. Since economy is a major consideration, every effort is made to utilize local building materials. Several of the experimental houses incorporate features commonly lacking in typical native homes, such as separate bedroom space, kitchen sinks, sanitary toilet facilities, ventilating devices, and, in one instance, an inside well.

Control of Insect Pests

The bloodsucking flies and their control comprise one of the most important environmental problems in Alaska. More than 100 species of mosquitoes, black flies, snipe flies, punkies, and horse flies occur in the State, and half of them bite humans. Their biting and the annoyance they cause are a severe handicap to essential outdoor occupations and to recreational activities, and their bites occasionally may lead to serious secondary infections or allergic reactions. Their status as vectors of disease is still unknown.

In southeast Alaska the biting-fly season lasts about 6 months, from mid-April into October. In localized areas, biting is intense for relatively short periods, depending on which pest is involved. The biting season becomes progressively shorter, but less localized and more intense, northward to the Arctic slope, where it lasts less than a month, during late June and early July. Along the Arctic slope, biting by insects is perhaps the most intense in the world, with a few species of *Aedes* mosquitoes almost the sole offenders.

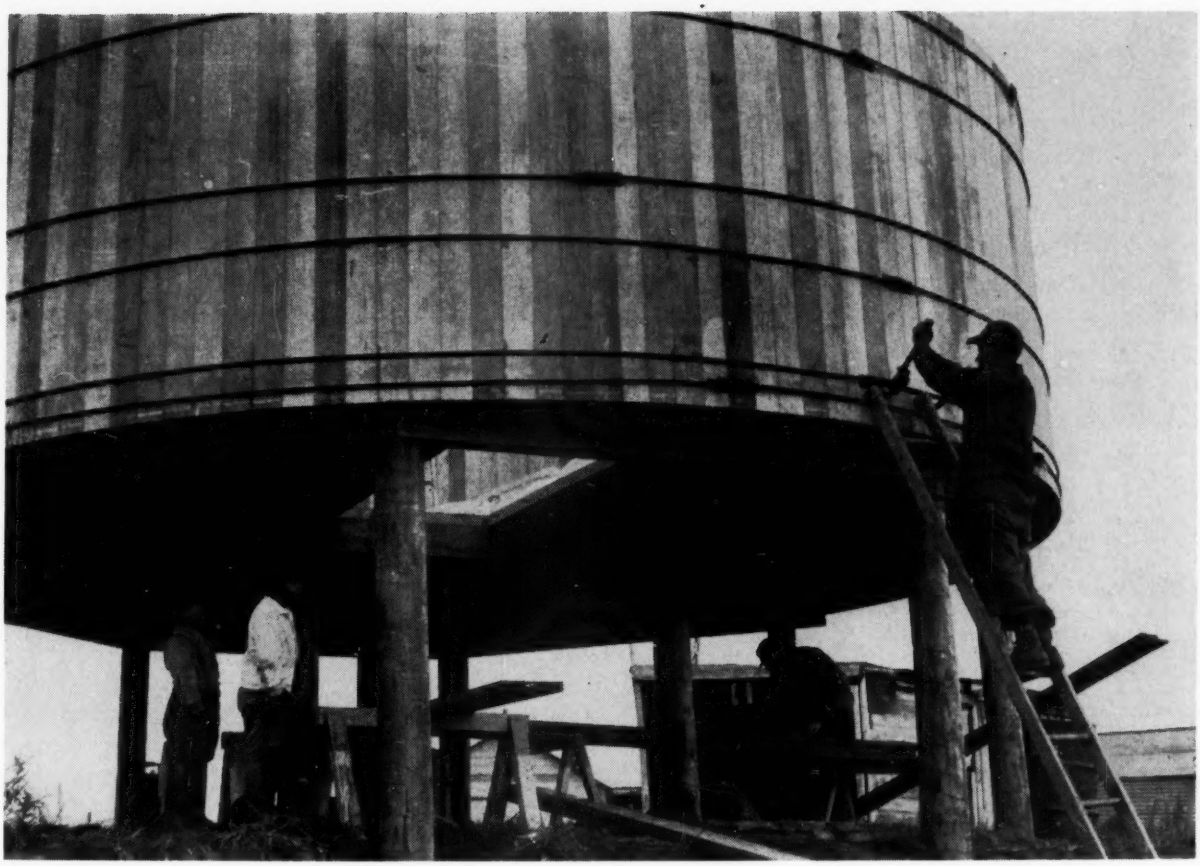
Throughout much of the State the mosquitoes (Culicidae) are considered the worst pest. In the forested regions the *Anopheles* and *Culiseta* females emerge from hibernation and begin to bite even before the snow has entirely disappeared. Biting increases as the *Aedes* matures, and the peak of the biting season is reached by mid-July.

Twenty-eight species of mosquitoes occur in Alaska, of which 10 are major pests, responsible for most of the biting. All Alaskan mosquitoes produce but one generation a year. They breed in stagnant water, and Alaska is well suited for them, with its vast expanses of boggy tundra, coastal marshes, swampy valleys, and upland bogs.

In some localities the black flies (Simuliidae) are considered worse pests than the mosquitoes. Of the 42 species of black flies known in Alaska, 11 are vicious biters. Reaction to bites is usually pronounced, and swelling and itching last a week or more and can be temporarily disabling.

Black flies, or "white sox" as they are called locally, breed in running water and in all kinds of streams, from the smallest trickle to large rivers. In some streams the larvae and pupae are of considerable importance as fish food. Most species produce one generation a year.

In the Panhandle and in some mountainous localities in central Alaska, the snipe flies (Leptidae, *Symphoromyia*) are the major pests during July and August. Two species are known to occur in Alaska and both bite humans.



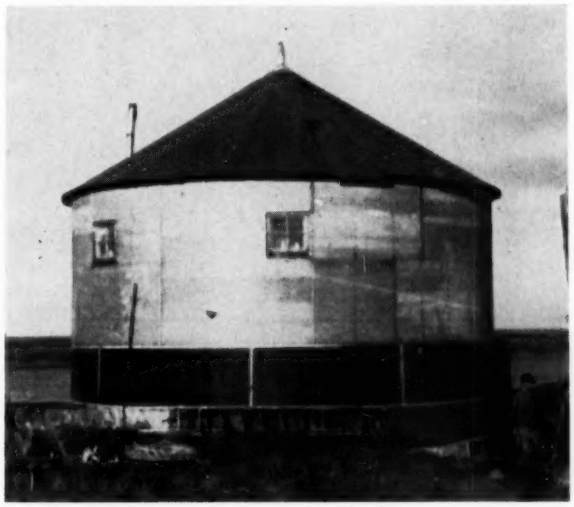
Beginning construction of experimental house at Eek (see center model, p. 906). Basic design patterned after circular wood stave water tank; circular shape minimizes effect of wind action and drifting snow.

The bite is decidedly painful, and since biting occurs in open areas in bright sunshine, snipe flies are particularly discouraging to outdoor activities.

The precise breeding place of snipe flies is unknown, but it is thought to be wet, peaty soil in the mountains near timberline.

In some coastal towns, and occasionally inland, the punkies (Heleidae, *Culicoides*) are the major outdoor pests. The biting season is from June through August, with July and early August the worst. At least six species are known to occur in Alaska and they all bite humans. The punkies breed in water or wet soil and along the coast in the intertidal mud where sedges are growing. The complete life history of only one species has been studied in Alaska, and it produces one generation a year.

In Alaska the horse flies (Tabanidae) are widespread, but they are usually slow to bite humans. About 30 species are known in the State and perhaps a third of them attack hu-

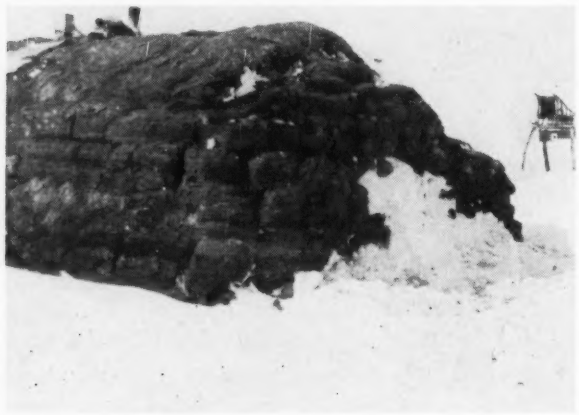


Completed experimental house at Eek. Entrance to living quarters is by stairs from below, to minimize heat loss. Enclosed space at ground level used for storage. Upper section (living quarters) insulated with plastic foam covered with exterior plywood; local grass used for insulation of lower section, covered with tar paper.

mans. Their chief importance is as pests of livestock and as possible transmitters of tularemia. They bite during bright sunshine when the temperature is high, around 70° F., during July and August. Tabanids usually breed in water or wet soil. Biological studies of these flies have not been made in Alaska.

Adulticiding with chemicals, mostly DDT, is the major insect control activity practiced in Alaska at present. It is expensive and gives only temporary relief but is used because the only biological information necessary is the flight and biting habits of the pest concerned. The insecticide is usually applied by airplane because few towns have the necessary roads for dispersal by ground mobile units. Stationary devices designed for dispersal of DDT aerosols and mists have proved fairly satisfactory for small installations such as camps, lodges, and homesites, but only when operated by trained personnel.

Larviciding provides more permanent control, and the biological information necessary for such an approach is now available to a large extent for the mosquitoes and to a lesser degree for the black flies and for one species of punkies. Biological information is entirely lacking for the snipe flies and horse flies. Also lacking are the trained personnel to make the preliminary habitat surveys required for effective larviciding. Black-fly ground larviciding should be done only by trained personnel because overdosage of chemicals would lead to disastrous results on fish spawning.



Sod-covered frame house, Point Hope. Note skylight and dog on roof.

Unfortunately, many of the most desirable permanent control measures, which do not involve chemicals, such as draining, filling, and flushing, are impracticable in Alaska because of the vastness of the breeding areas. Even in southeast Alaska, where the mosquito-breeding sites are limited by sea and mountains, dense undergrowth prevents the use of satisfactory control measures. But adulticiding and larviciding are economically feasible, especially in densely populated areas, when properly done.

Biting flies are a community problem—so also is their control. Community organization in the form of abatement districts, with trained personnel to perform the control operations, is needed for efficient control of these pests without risk to fish or wildlife, two of Alaska's important natural resources.

Food and Nutrition

Generalizations as to dietary practices and nutrition in Alaska are impractical because local circumstances alter custom. Actual food intakes, in any locality, are determined by cost, availability, and individual preference, usually in that order. Where direct transportation from the "southern 48" is available, cost is the controlling factor in dietary practices. In remote areas, availability dictates the diet.

Since the bulk of Alaska's food supply is imported, the resultant high cost of various items has a direct bearing on the dietary habits of almost all Alaskans, for few families nowadays, however remotely located, follow the old ways of gathering food from local sources exclusively. Overall consumption of fresh fruits and vegetables and whole fluid milk is below national averages, because a high proportion of these items must be imported.

Table 8 provides a comparison of current retail prices of selected food items in certain Alaskan cities with prices of these items in the United States and Seattle. All of the cities listed, except Nome, have direct access to surface routes, either water or highway, as well as air transportation the year round. Nome prices are therefore more typical of those found in outlying areas to which food supplies must generally be reshipped by air from the major transportation centers.

Table 8. Average retail prices of selected food items in five Alaskan cities, compared with Seattle and United States, March 1960 [1]

Food item	Unit	U.S. average	Seattle	Ketchikan	Juneau	Anchorage	Fairbanks	Nome
Flour	5 lb.	$0.55	$0.58	$0.72	$0.78	$0.80	$0.94	$0.94
Bread	1½ lb.	.30	.35	.42	.46	.47	.48	.55
Ground beef	1 lb.	.52	.49	.69	.64	.64	.82	.90
Milk	Quart	.25	.23	.36	.35	.40	.48	.73
Milk (evaporated)	14½ oz.	.16	.16	.18	.18	.20	.22	.23
Orange juice (frozen)	6 oz.	.23	.24	.30	.28	.31	.41	.49
Oranges	1 lb.	.21	.25	.22	.28	.26	.26	.47
Lettuce	1 lb.	.20	.17	.28	.32	.32	.44	.61
Eggs (large grade A)	Dozen	.48	.56	.60	.56	.58	.78	1.06
Butter	1 lb.	.74	.75	.79	.78	.85	.91	1.11
Total price of 40 "market basket" items		$15.75	$16.64	$19.48	$20.17	$21.16	$24.80	$28.37
Percentage of Seattle prices		95	100	117	121	127	149	170

[1] See reference 15.

Although dairy and poultry farming are leading sources of income among Alaskan farmers, high local production costs keep retail prices of these items in local markets high. Thus, Alaska-produced eggs must compete with lower priced eggs imported by air, highway, or water. Fresh grade A jumbo eggs produced in the nearby Matanuska Valley, for example, are currently selling in Anchorage markets for $1.09 a dozen, while some Anchorage grocers are advertising specials of imported grade AA medium eggs for 49 cents a dozen.

Truck farming in Alaska is increasing steadily, and locally grown vegetables appear seasonally in local markets and at roadside stands in increasing quantities each year. Here again, however, local produce is not yet grown in quantities sufficient to compete in price with the volume imported by wholesale firms. Nor, of course, can local producers compete on a year-round basis.

Some newcomers to Alaska still regard Alaska-grown vegetables with some suspicion, apparently assuming that jumbo size and rapid growth must mean a tough, unpalatable product. Actually, Alaska's vegetables, harvested in their prime, possess superior palatability. Most of the crops, because of their rapid growth, are harvested while still relatively young and tender. Salad crops, for example, are sometimes marketed when no more than 4 weeks old.

In general, the non-native in Alaska eats as well as his "southern" neighbor, if at greater expense. Unless his fixed expenses for items such as housing, utilities, and clothing demand a disproportionately large share of his income, his diet is generally adequate.

The diet of the Alaskan Eskimo and Indian is undergoing marked changes. The entire native population is going through a rapid cultural transition, and many have abandoned the life of the nomad hunter to work for wages. Unfortunately the time for wage work, usually seasonal in Alaska, coincides with the time when native food-gathering activities would normally occur.

Many natives have developed a liking for "white man's foods," often, unfortunately, for the less nutritious items. They have become particularly fond of coffee, tea, candy, pop, chewing gum, especially bubble gum, macaroni, "store" bread, and prepared cake and other mixes. Whereas formerly the bulk of their diets consisted of fish, often eaten whole, or meat eaten raw or partially cooked, they are substituting processed or canned foods whenever cash income will permit.

According to laboratory analyses, many of the native foods, now being abandoned, are of high nutritive quality. The most important natural Alaskan sources of vitamin A are animal livers, sea mammal oils, and wild edible greens. The fresh wild greens are excellent sources of ascorbic acid, as are cloudberries and some of

the fresh seaweeds. A mere 100 grams of seaweed is equal in ascorbic acid content to a medium-sized orange. Good iron sources are available from both land and sea mammal livers, wildfowl, wild edible greens, blackfish and needlefish, especially the latter two, since the Eskimo eats the entire fish, including the entrails. Clams, blackfish and needlefish, willow leaves, and certain seaweeds (*Alaria*, *Laminaria*, and *Agarium*) are rich in calcium.

The supplemental feeding program in the Bureau of Indian Affairs schools has influenced eating habits in some villages. Many of the foods served at school as hot breakfasts, lunches, or "snacks", have become favorites with the children. Teachers try to use these supplemental feedings as learning situations. Village women sometimes help with the lunch program, thus affording additional opportunity for nutrition education.

During the past few years, increased welfare allowances under the aid to dependent children and old-age assistance programs have made regular purchase of store foods possible. In many instances considerably more guidance in wise purchasing and economical use of purchased foods is needed. The village store or trading post usually constitutes the main source of supply, although some individuals and families have adopted the practice of ordering food supplies by airmail order or charge account from the nearest city. The village trader usually stocks his shelves according to local demands, and itinerant health personnel frequently suggest to him the stocking and promoting of certain items, such as powdered milk, as a means of encouraging greater as well as more economical use of milk.

Food intakes among native groups in Alaska vary according to location as well as income. While seasonal shortages in the natural food supply occur occasionally in all parts of Alaska, they are usually more severe and more frequent in the tundra areas than in coastal villages.

The trend toward larger and permanently located villages also influences food supply. Populations of some villages are increasing, largely as a result of decreasing mortality rates. In other villages, establishment of permanent schools and post offices has attracted new residents from surrounding communities. Natural food supplies around these growing villages are dwindling as the hunters and trappers tend to confine their food-gathering activities to a smaller radius.

From the standpoint of changed feeding practices, the nutrition of the infant and preschool child is probably in the most precarious situation. Whereas in earlier days the Eskimo mother breast fed her baby for at least 2 years or longer, the practice of bottle feeding, learned during periods of hospitalization for tuberculosis or through other contacts, has been widely adopted. While the small infant on the bottle generally receives a formula of half evaporated milk and half water and is fed on demand, toward the end of the first year the proportion of milk to water is often drastically reduced.

The idea of supplemental feedings for the bottle-fed baby is slowly being adopted. In some villages health and medical personnel have succeeded in influencing village councils to provide, at village expense, suitable vitamin preperations for all mothers with small infants. School-age children have been receiving multivitamin pills in conjunction with the Bureau of Indian Affairs school lunch program for the past several years. Multivitamin pills also have been distributed to participants in the tuberculosis chemotherapy program. To date, however, the toddler and the preschool child have not generally been included in these programs.

In spite of the numerous nutritional hazards noted, a recent survey (*16*) has revealed that specific nutritional deficiencies are not a health problem among adult Eskimos and Indians at this time. Despite low intakes of certain nutrients, little clinical evidence of deficiencies was discovered.

Study of dietary records collected seasonally, in conjunction with the above survey, from nine Eskimo and two Indian villages over a period of 2½ years has afforded much valuable information. The following comments are based on preliminary analyses of some of the survey findings.

Except during food shortages the protein intake of Eskimos and Indians is more than adequate. Intakes of carbohydrate, fat, vitamin A, thiamin, riboflavin, niacin, and iron vary widely among residents of the villages under

Preparing to butcher a beluga, or white whale, favorite meat of Eskimos along the northwest coast of Alaska and the lower Yukon River. Rack under whale represents forward step in sanitary handling of food. Formerly butchering table was the beach itself, often littered with soil from both dogs and humans.

study. Dietary intakes in some villages show obvious nutritive shortages when compared with allowances recommended by the National Research Council. Notable among these shortages are iron, in the tundra villages where the main source of protein and iron is fish, vitamin A, and ascorbic acid. Calories from fat make up from 22 percent to more than 50 percent of the total calories; the total calorie intake is often well below that recommended by the National Research Council for comparable age groups.

Outlook

Alaska has made considerable progress against great odds in the field of health and medical care in the last 20 years. The outlook for continued health progress in the 49th State is promising, but so many contingencies are involved that predictions can be little more than arbitrary conjectures.

Alaska has abundant resources, sufficient to support a much larger population, but needs more capital and more people to develop these resources.

It seems likely that Alaska's present major health problems—those stemming from infectious diseases and inadequate sanitation—will continue to claim priority for some time. Most of these problems could be reduced materially with sufficient health personnel and facilities for service, education, and research. Much of Alaska's past progress in overcoming major health problems can be attributed to strong Federal support and increasing Territorial-State appropriations.

Alaska also needs a larger and more stable population for development of potential leaders in the health professions. The interest and intent to develop training facilities for medical and paramedical personnel within the State are already evident.

Alaska's greatest resource is people. The

determination and willingness of Alaskans to attack seemingly insurmountable problems have been amply demonstrated. Given an adequate financial base and wise leadership, the 49th State should be well able to sustain and expand present health services and facilities to meet increasing and emerging demands.

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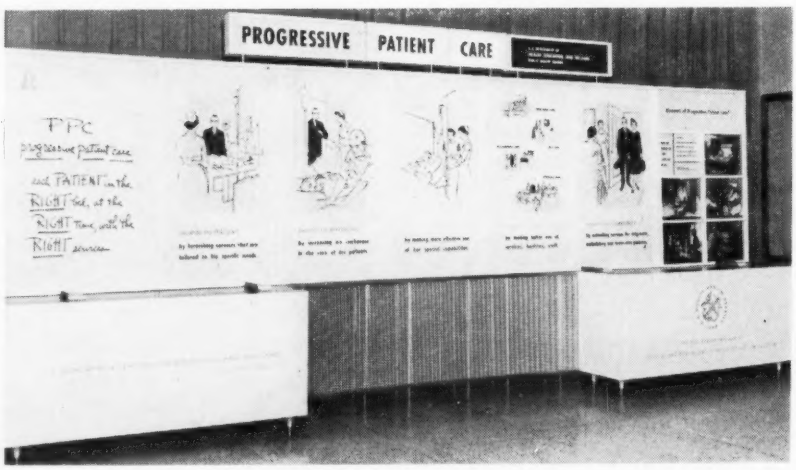
exhibits

Progressive Patient Care

Progressive patient care, the concept of tailoring medical services to meet the patient's needs, is the subject of an explanatory pamphlet and exhibit developed by the Division of Hospital and Medical Facilities, Public Health Service.

The five elements of patient care encompassed by PPC, as the plan is called, are explained as intensive, intermediate, self- and long-term care within the hospital, and home care.

Benefits are described as services tailored to the patient's needs, increased confidence by physicians in the care received by their patients, more effective use of the nursing staff, better use of hospital services, facilities, and staff, and extended services to the community for long-term ambulatory and home care patients.



Specifications: A 7-panel exhibit, 18 feet long, 7 feet 6 inches high, and 2 feet deep; total weight about 1,300 lbs., including the 4 packing crates. Literature may be displayed on the top of the cabinets at each end. One 500-watt and one 250-watt electrical connections are required.

The exhibit is available for loan without charge, exclusive of shipping charges.

Further information, including arrangements for borrowing, can be obtained from the Division of Hospital and Medical Facilities, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

Salmonella in Alaska

RALPH B. WILLIAMS, B.S., and MARIE W. DODSON, M.S.

TWENTY-ONE years of observation on the occurrence of salmonellosis in Alaska have been completed, and the findings are reported here. Much of the data presented are the result of detailed bacteriological studies on specimens received routinely in the four diagnostic laboratories of the Alaska Health and Welfare Department's Division of Health. The remainder are from reports made by Grumbles and Maciolek (*1*), Gordon and Babbott (*2*), Cullison (*3*), Fournelle and associates (*4*), Pauls (*5*), and Gaub (*6*), or from direct contact with personnel in hospitals and research laboratories in Alaska (personal communications from William H. Gaub, 1952; Alice T. Howarth, 1959; and Jerome P. Schmidt, 1959).

At least 60 percent of the isolations were from patients suspected of having enteric infections and from contacts in the course of infrequent epidemiological studies. The remainder were from the work of survey teams examining normal human and animal populations in Eskimo and Indian villages. We have relied upon the written and published reports of these observers, some of whom relied on our laboratories for the bacteriological phases of their projects.

Bacteriological procedures used have been modified from time to time, but since 1955 the techniques have closely conformed to those described by Edwards and Ewing (*7*).

The present work is a summation of the results obtained in the study of 246 *Salmonella* from various localities throughout Alaska. The most frequent type was *Salmonella typhimurium*. There were 81 strains isolated since the first of this type was cultured from 2 cases of salmonellosis in a February 1945 foodborne outbreak involving 17 children in a children's home near Auke Bay, Alaska. The remainder included 25 different serotypes, of which *S. typhosa* (68 strains) and *S. montevideo* (19 strains) were the next most common types encountered. Five other types frequently encountered were *S. reading* (11 strains), *S. muenchen* (10 strains), *S. oranienburg* (7 strains), *S. newport* (7 strains), and *S. enteritidis* (6 strains). The *S. typhosa* strain isolated February 18, 1938, from a Ketchikan patient was the first *Salmonella* cultured in Alaska.

Since 1944 the specific rank of each antigenically distinguishable type of *Salmonella* isolated has been verified by the Communicable Disease Center, Public Health Service, Chamblee, Ga., or the Salmonella Typing Center, University of Kentucky, Lexington.

In the accompanying table, the serotypes are listed in the order of greatest frequency, and the rarer types, of which only one or two strains were reported, follow in the order of the numbers isolated. The final group of five strains was not classified as to types, but only as to genus and therefore is listed last. Types were distributed among human beings, both children and adults, dogs, fur seal pups, seal lice, and gulls.

Three types, *S. minnesota* (1 strain, dog), *S. sandiego* (1 strain, gull), and *S. enteritidis* (6 strains, isolated by Jellison and Milner (*8*), from fur seal pups and seal lice) came from animal sources and were not isolated from man.

Seventeen types, isolated from man, came

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mainly from cases reported as mild to severe gastroenteritis or diarrhea occurring with greatest frequency in young children. Investigators at the Arctic Aeromedical Laboratory, Ladd Air Force Base, Fairbanks, in 1958 found that at Fort Yukon intestinal disturbances occurred eight times more often in children aged 0–9 years than in any other age group. A report on the results of this study is in preparation.

The occurrence of intestinal infections in Alaska has been reviewed by Gordon and Babbott (*2*), Fournelle and associates (*4*), and others. The division of health morbidity records support their findings and show prevalence of these infections to be greatest during July and August, with the highest incidence in children under 10 years of age. Single strains of *S. bareilly*, *S. cubana*, *S. derby*, *S. give*, *S. heidelberg*, *S. newington*, *S. paratyphi*, *S. urbana*, 2 strains of *S. infantis*, 10 strains of *S. muenchen*, 7 strains of *S. newport*, 2 strains of *S. panama*, 11 strains of *S. reading*, 4 strains of *S. tennessee*, 3 strains of *S. thompson*, 2 strains of *S. worthington*, and 68 strains of *S. typhosa* were isolated from human cases and carriers. The remaining types were isolated from both man and animals. *S. oslo* (3 strains), *S. montevideo* (19 strains), and *S. oranienburg* (7 strains) were isolated from man and dogs, while *S. schottmuelleri* (2 strains) and *S. manhattan* (4 strains) were isolated from man and gulls (*Larus glaucescens*). *S. typhimurium* was isolated from man, dogs, and gulls.

Poultry and other birds are frequently associated with salmonellosis in other parts of the world. However, poultry and other domestic birds are not common in Alaska, but 77 different species of wild birds, totaling 399 individuals, were collected during the period September 22, 1944, to May 5, 1955. The majority of these were migrant birds visiting southeastern Alaska. A few birds were collected in the Fairbanks area and along the Richardson and Glenn Highways to and including the Anchorage area. The contents of the gizzard and intestine were cultured directly on *Salmonella-Shigella* agar and into enrichment broths and, with the exception of pellets and intestinal contents from *L. glaucescens*, were negative for salmonellae.

In addition to 14 gulls collected and examined in Ketchikan (*9*) (1 strain of *S. manhattan*), 173 gull pellets, indigestible material cast out by regurgitation, were examined at Juneau during December–March of each of the years 1951–55. Two strains of *S. typhimurium*, one strain of *S. schottmuelleri* phage type variation of group I, and one strain of *S. sandiego* were isolated.

A survey of *Salmonella* in dogs in Alaska was made by Schlotthauer in 1955–56 (personal communication). A total of 452 samples were collected by means of rectal swabs for bacteriological examinations and 1.5 percent of the animals sampled had *Salmonella*. Six isolations of *S. typhimurium* were made at Fort Yukon in June 1955 and one isolation of *S.*

Frequency of occurrence of Salmonella types

Salmonella type	Strains		*Salmonella* type	Strains	
	Number	Percent		Number	Percent
S. typhimurium	81	32.9	*S. schottmuelleri*	2	0.8
S. typhosa	68	27.7	*S. worthington*	2	.8
S. montevideo	19	7.7	*S. bareilly*	1	.4
S. reading	11	4.5	*S. cubana*	1	.4
S. muenchen	10	4.1	*S. derby*	1	.4
S. oranienburg	7	2.9	*S. give*	1	.4
S. newport	7	2.9	*S. heidelberg*	1	.4
S. enteritidis	6	2.5	*S. minnesota*	1	.4
S. manhattan	4	1.6	*S. newington*	1	.4
S. tennessee	4	1.6	*S. paratyphi*	1	.4
S. thompson	3	1.2	*S. sandiego*	1	.4
S. oslo	3	1.2	*S. urbana*	1	.4
S. infantis	2	.8	*Salmonella* spp	5	2.0
S. panama	2	.8			

montevideo from a Ladd Air Force Base dog during May 1956. No isolations were made during the autumn periods of the years 1955–56. The survey teams working in the Eskimo and Indian villages collected specimens from dogs as possible sources of human infections. *S. typhimurium* was the only type isolated.

The 26 types isolated in Alaska were classified into the O groups of the Kauffmann-White schema (*10*) with the following distribution:

Group	Number of types	Number of strains
A	1	1
B	6	97
C_1	7	39
C_2	3	21
D	3	76
E_1	1	1
E_2	1	1
E_3	None	
E_4	None	
F	None	
G	2	3
H	None	
I	None	
Further groups	2	2
Unclassified		5

Thus far experience has shown that the majority of types encountered in Alaska belong to groups B, C_1, C_2, and D, to which 233 strains were assigned out of the 246 *Salmonella* reported. The other eight strains classified represented a single strain for each group A, E_1, and E_2, three strains for two types in group G and a single strain each for two types not assigned by the schema to specific groups. Kauffmann (*10*) reports that in other parts of the world the majority of *Salmonella* most frequently cultured are in the first five groups, A, B, C, D, and E.

The data on the clinical cases were too limited for detailed comment, except to note that specimens sent to aid in diagnosis for diarrheal disease were frequently found to contain *Salmonella*. A handicap of many past investigations of enteric disease in isolated and remote areas of Alaska has been their retrospective character. In a number of cases, the major epidemic wave was over when detailed analyses were begun. Obvious limitations resulted, particularly regarding observation of acute phases of the illness. The clinical impressions obtained from the data supplied did not materially differ from those reported elsewhere. An investigation by Cullison and Davis (*11*) of the population at Barrow for salmonellosis showed a relatively high incidence of the causative organisms in all age groups. A seasonal variation was demonstrated with 100 percent increase of isolations in summer as compared with those in winter.

Geographically the various *Salmonella* types were scattered widely. The evidence did not suggest that there were foci of infection with the different types.

Many of the isolations were from apparently healthy individuals. Followup specimens were submitted on individuals found to be carriers. The data suggest that the carrier state is relatively transient. Repeated isolations were uncommon over a long period of time and the organisms could not be cultured after 3 to 4 months. An exception was the *S. typhosa* carriers from whom cultures have been repeated years after the initial isolation.

ADDENDUM: Two additional serologic types of *Salmonella* and another strain of *S. derby* have recently been isolated in Alaska: *S. blockley* from a child; *S. anatum* from an infant; and *S. derby* from commercial dog meal.

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CDC Training Program, 1960–61

Training courses in the epidemiology and control of communicable diseases offered by the Communicable Disease Center, Public Health Service, from October 1960 through June 1961 are listed below. This list, together with the courses in laboratory methods listed in *Public Health Reports*, July 1960, represents the complete schedule for the period. Courses listed under "Organization and Orientation" are especially developed for people from other countries. Additional information and application forms may be obtained from either the Chief, Communicable Disease Center, Atlanta 22, Ga., or the appropriate regional office of the Department of Health, Education and Welfare.

Epidemiology

Principles of epidemiology (101). Jan. 16–20; Atlanta.
Applied epidemiology (112). Nov. 14–18; Atlanta. Apr. 10–14; Cincinnati.
Epidemiology for nurses (121). Spring; Atlanta.
Principles of epidemiology for nurses (122). To be announced; by arrangement with schools of nursing in universities and colleges.
Epidemiology for veterinarians (140). Feb. 6–10; Atlanta.

Vector Control

Epidemiology and control of vector-borne diseases (201). Feb. 13–17; Atlanta. Apr. 3–7; Denver.
Rodent control, operational (212). By arrangement; Atlanta.
Insect and rodent control (221). June 5–16; Atlanta.
Mosquito control (231). Oct. 31–Nov. 4; Atlanta.
Identification and biology of arthropods (241). Jan. 9–20; Atlanta.

Environmental Control

Environmental sanitation (301). Feb. 13–May 12; Atlanta.
Epidemiology and control of food-borne diseases (311). Nov. 14–18; Region II. May 22–26; Atlanta.
Applied procedures for control of food-borne diseases (312). Oct. 24–28; Denver.
Milk pasteurization controls and tests (332). Oct. 3–21; Region II. Nov. 1–3; Atlanta. Spring (2 weeks); Region III. Spring (3 weeks); Region IV.
Milk sanitation, administrative (333). Feb. 6–10; Denver.
Housing hygiene, operational (363). Mar. 13–Apr. 14; Atlanta.
Housing hygiene, environmental (367). Mar. 27–31; Atlanta.

Venereal Disease Control

Venereal disease annual postgraduate course (401). Time and place to be announced.
Nursing work conferences on the control of venereal disease (421). Time and place to be announced.
Nursing in venereal disease control (422). Monthly, September through June; New York Department of Health, Bedford Health District, John F. Mahoney Training Center, Brooklyn.
Venereal disease contact interview and investigation (431). Oct. 24–Nov. 4; Jan. 16–27; Feb. 20–Mar. 3; Mar. 27–Apr. 7; May 15–26; Venereal Disease Training School, Fulton County Health Department, Atlanta. Nov. 28–Dec. 9; Jan. 16–27; Mar. 20–31; May 8–19; Venereal Disease Training School, Detroit City Health Department. Nov. 14–25; Feb. 6–17; May 8–19; Venereal Disease Training School, Los Angeles Department of Health.
Current laboratory methods in the serology of syphilis (454). Nov. 28–Dec. 16; Jan. 30–Feb. 17; Apr. 10–28; Chamblee.
Management and control of syphilis serology by the central laboratory (455). May 8–19; Chamblee.
The *Treponema pallidum* immobilization (TPI) test (456). By special arrangement only; Chamblee.
Introduction to fluorescent antibody methods—identification of the *Neisseria gonorrhoeae*. Oct. 17–21; Mar. 6–10; Chamblee.
The fluorescent treponemal antibody (FTA) test (458). Oct. 24–28; Mar. 13–17; Chamblee.

Laboratory Methods

Fluorescent antibody techniques in the public health laboratory (845). Nov. 7–18; Atlanta.

Organization and Orientation

Principles, organization, and practice of communicable disease control (701). Summer 1961; Atlanta.
Applied epidemiology in communicable disease control (712). June 19–July 14 (tentative); Atlanta.
Nursing aspects of communicable disease control (720). June 26–30 (tentative); Atlanta.
Environmental aspects of communicable disease control (730). June 12–July 7; Atlanta.

The designation Leptospira mini georgia is proposed for a new subserotype of L. mini isolated from wild mammals. A case of human infection with L. mini georgia is reported on pages 922–924 and the first isolation of Leptospira pomona from a woodchuck, on page 925.

A New Leptospiral Subserotype in the Hebdomadis Group

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INVESTIGATIONS concerning possible wild animal reservoirs of leptospires were conducted by the Communicable Disease Center of the Public Health Service from 1953 to 1958 at Newton, Ga. (*1–3*). Leptospires isolated between March 1956 and May 1957 from 15 raccoons (*Procyon lotor*), 4 opossums (*Didelphis marsupialis*), and 1 striped skunk (*Mephitis mephitis*) appeared to be identical and to belong to the hebdomadis serogroup. Serologic characterization of these strains, recorded in this paper, indicate that they are a new subserotype of *Leptospira mini.*

L. mini AB Sari was isolated by Mino in 1941 from the blood of an Italian ricefield worker with leptospirosis and described by Babudieri (*4*). *L. mini A* Szwajizak was isolated first in Queensland in 1952, also from the blood of a human patient, and reported by Smith and coworkers in 1954 (*5*). Several years later Van der Hoeden (*6*) isolated the Szwajizak strain from the kidneys of a hedgehog in Israel. The Barthélémy strain was isolated by Van Riel and Szpajshendler (*7*) from the blood of a patient with a fatal case of leptospirosis in the mining region of the Belgian Congo.

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Methods

Source of strains. All the animals from which leptospires were isolated were trapped in Georgia, 11 in Calhoun County, 5 in Dougherty County, and 2 each in Baker and Seminole Counties. These counties are in the southwestern part of the State between the Flint and Chattahoochee Rivers. The leptospiral strains were isolated by direct culture of a kidney tissue suspension into Fletcher's semisolid medium (*8*).

Antiserums. Immune serums were prepared according to previously described methods (*3*) with the exception of *L. wolffii A*, *L. borincana*, *L. worsfoldi*, *L. hemolyticus*, *L. ricardi*, *L. jules*, *L. mini A* Szwajizak and *L. kabura*, which were prepared by inoculation of live Fletcher's cultures into rabbits. These eight antiserums were supplied by the Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D.C.

Antigens. Leptospiral antigens were pre-

pared as previously described (*3*) except they were not formalinized. If the antigens appeared too dense, cultures were diluted with sterile Stuart's medium (*9*).

Microscopic agglutination test procedure. Serial twofold dilutions were prepared in buffered 0.85 percent saline to provide serum dilutions of 1:25 through 1:102,400. To 0.2 ml. of each serum dilution, 0.2 ml. of antigen was added. The tubes were shaken, incubated at 30° C. for 3 hours, and examined. A drop from each dilution was placed on a slide and examined by dark ground microscopy, using low-power objective and 15× oculars without a coverslip. The degree of agglutination or "lysis" or both were read as 1+, with at least 25 percent of the leptospires agglutinated or "lysed"; 2+, approximately 50 percent; 3+, about 50–75 percent; and 4+, 75–100 percent. The end point was taken as the last dilution showing a 1+ reaction.

Agglutinin-absorption procedure. Antigens for absorption studies were prepared from 5- to 7-day-old cultures grown in Stuart's medium in 500 ml. amounts. Cultures were killed by the addition of formalin to provide a concentration of 0.3 percent. The cultures were centrifuged at 5,000 × gravity in a Servall for 25 minutes. The remainder of the agglutinin-absorption procedure was essentially the same as that described by Alexander (*10*). Microscopic agglutination tests with the absorbed serums were performed with antigens prepared as mentioned above but killed by the addition of formalin to provide a concentration of 0.3 percent. The absorbed serums were diluted twofold to provide final serum dilution of 1:100 to 1:51,200 after the addition of antigen. The tubes were incubated in a waterbath at 52° C. for 2 hours, refrigerated for 1 hour, and read as described above.

Findings

The first isolate in this group of cultures, LT117, grew very slowly in liquid medium for the first 10 months and was carried in both Stuart's and Chang's (*11*) media. Frequently the culture failed to grow in one of these liquid media and it was necessary to continue to subculture in Fletcher's medium and transfer repeatedly from these to the liquid media before the culture became adapted. However, after about 12 months the culture began to grow quite well in Stuart's medium and has continued to do so.

Initial screening of antigen prepared from strain LT117 with antiserums against *L. aus-*

Table 1. Cross agglutination studies on leptospiral strain LT117 and related isolates

Antiserum	Homologous titer	Antigen [1]										LT117 serum + 1–18 antigens
		LT117	LT138	LT146	LT153	LT164	LT172	LT185	LT186	LT188	LT196	
hebdomadis	12, 800	800	400				400	800	800	800	800	400
medanensis	12, 800	–	–	–	–	–	–	50	–	–	–	64
wolffii	12, 800	200	256	128	128	32	200	200	50	100	100	32
hardjo	51, 200	–	–	–			–	–	–	–	–	32
sejroe	6, 400	50	–	128	128	–	–	100	50	–	100	–
saxkoebing	25, 600	200	200				100	400	200	100	800	50
wolffii A	51, 200	200	256	512	128	64	–	100	–	–	400	512
kremastos	6, 400	3, 200	1, 024	1, 024	1, 024	512	800	1, 000	800	800	800	256
borincana	51, 200	12, 800	16, 384	4, 096	4, 096	8, 192	6, 400	25, 600	6, 400	6, 400	6, 400	32
worsfoldi	102, 400	12, 800	6, 400	2, 048	4, 096	2, 048	12, 800	25, 600	6, 400	6, 400	6, 400	128
hemolyticus	51, 200	400	200	1, 024	256	128	100	400	200	200	400	512
mini A Szwajizak	51, 200	25, 600										3, 200
mini AB Sari	6, 400	400	512	512	512	256	400	400	400	400	400	1, 600
jules	25, 600	12, 800	12, 800				3, 200	6, 400	3, 200	3, 200	12, 800	200
kabura	102, 400	3, 200	1, 600				1, 600	3, 200	1, 600	1, 600	6, 400	400
barthélémy	12, 800	6, 400										800
ricardi	51, 200	–	–	–	–	–	–	–	–	–	–	128
LT117	6, 400	6, 400	3, 200	2, 048			6, 400	12, 800	6, 400	6, 400	12, 800	6, 400

[1] Live antigen.

NOTE: – indicates no reaction in a 1:50 dilution.

tralis, LT95; *L. autumnalis* (AB), Akiyama A; *L. bakeri; L. ballum*, S102; *L. grippotyphosa*, Moscow V; *L. pomona*, LT91; and *L. sejroe* Mallersdorf, the battery used to test isolates from this Communicable Disease Center field station, yielded agglutination only with *L. sejroe* serum in a dilution of 1:50. Subsequent testing with antiserums for the remaining 28 serotypes recognized in the Wolff-Broom schema (*12*) revealed similar low titers with other members of the hebdomadis serogroup. Antiserum against LT117 was then prepared and cross agglutination studies performed with live antigens and antiserums of serotypes of the hebdomadis serogroup (*13*). Results of these studies indicated that LT117 was closely related to the hebdomadis serogroup, as shown in table 1.

In agglutinin-absorption studies with *L. borincana*, *L. worsfoldi*, *L. kremastos*, *L. hemolyticus*, *L. wolffi A*, *L. mini AB* Sari, *L. mini AB* Barthélémy, *L. mini A* Szwajizak, *L. jules*, and *L. kabura* antiserums, LT117 failed to reduce the homologous titer significantly except in the *L. mini* antiserums. The serologic characteristics of the Barthélémy strain were described recently by Wolff and Bohlander (*14*), and it was shown to be very closely related to Sari. For practical reasons they considered Barthélémy as a complete biotype of *L. mini*. To confirm the apparent serologic relationship between LT117, Sari, and Szwajizak, a box titration of the cross agglutinin-absorption reactions among these three strains was performed by A. D. Alexander and L. B. Evans, Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D.C. These findings, as shown in table 2, indicate that LT117 is a subserotype of *L. mini*. Therefore, the subserotype designation *L. mini georgia* is proposed for strain LT117.

During these studies, 19 additional isolates were obtained from raccoons, striped skunks, and opossums that reacted to the homologous titer with LT117 antiserum. Nine of these cultures were tested against antiserums for other members of the hebdomadis serogroup and showed a cross agglutination pattern similar to LT117 as shown in table 1.

Blood was collected from each of the animals the same day the kidney suspensions were cultured. The serum from 16 animals was available for agglutination studies. Of these significant antibodies against LT117 were detected in dilutions ranging from 1:50 to 1:800 in eight animals. Four of the samples were tested with antigens of all serotypes of the hebdomadis group except *L. ricardi*, and no antibodies were detected in two. A titer of 1:200 to Sari was observed in the serum from one skunk that showed only a plus minus reaction (at the lowest dilution, 1:50) with LT117 antigen. These findings are shown in table 3.

Discussion

L. mini georgia represents the second new leptospiral strain that has been isolated in the United States. Since 1952 (*15*) increasing serologic evidence has suggested that infections with another member of the hebdomadis group, *L. sejroe*, occur in cattle. While the etiological significance of these bovine *sejroe* reactors has not been determined completely, infection with *L. hardjo*, a closely related serotype, has been

Table 2. Results of cross agglutinin-absorption test with L. mini AB Sari, L. mini A Szwajizak, and LT117 [1, 2]

Antiserum	Antigen		
	Sari	Szwajizak	LT117
L. mini AB Sari:			
Unabsorbed	25, 600	25, 600	6, 400
Absorbed with:			
Sari	—	—	—
Szwajizak	1, 600	—	—
LT117	6, 400	400	—
L. mini A Szwajizak:			
Unabsorbed	6, 400	25, 600	6, 400
Absorbed with:			
Sari	—	—	—
Szwajizak	—	—	—
LT117	400	400	—
LT117:			
Unabsorbed	1, 600	25, 600	25, 600
Absorbed with:			
Sari	—	100	1, 600
Szwajizak	—	—	1, 600
LT117	—	—	—

[1] Titer expressed as reciprocal of serum dilution.

[2] The techniques employed in these tests are described by A. D. Alexander, L. B. Evans, H. Jefferies, C. A. Gleiser, and R. H. Yager in "Serologic Characterization of the Fort Bragg Leptospire," Proc. Soc. Exper. Biol. & Med. 86: 405–408, June 1954.

NOTE: — indicates no reaction in a 1:100 dilution.

established in Louisiana (*16*). The possibility that *L. mini georgia* may be involved in leptospirosis in cattle should be considered.

Serums from 6 of the 11 raccoons and 1 of 4 opossums tested were serologically negative against LT117. Serum from two of these six raccoons and the opossum showed a very weak reaction in a 1:50 dilution to Sari antigen. Another raccoon was positive at 1:50 with *kabura* antigen, but no antibodies to other members of the hebdomadis group were detected in serum from three of the raccoons. This is not unusual as similar findings were observed by Broom and Coghlan (*17*) in Scotland in serums from mice that were infected with *L. ballum* and with an unidentified member of the hebdomadis group. These authors pointed out the apparently misleading picture that serologic surveys may give concerning the prevalence of leptospirosis in small rodents. It is obvious that a similar situation exists also in the larger wild mammals, such as raccoons.

Subsequent to the isolation of the LT117 cultures from wild animals, serologic evidence of human infection with this serotype was seen in a patient in the Phoebe Putney Memorial Hospital, located in the same county in which several isolates were obtained. The initial serum sample from this patient showed a positive slide agglutination test with leptospiral pooled antigens but no reaction by microscopic agglutination when tested with live antigens for the routine battery of 12 leptospiral serotypes (*18*). A second sample requested a week later showed a microscopic titer of 1:200 against LT117 antigen.

Investigation of this suspected human case of leptospirosis by Dr. L. E. Starr, Georgia Department of Public Health, revealed an interesting history. The patient's physician stated that she had experienced an acute febrile illness of about 1 week's duration, accompanied by muscle aches, chills, and nausea. Tetracycline therapy was commenced about the fourth day after the onset of illness and continued for 6 days. Several weeks prior to onset of her illness the patient had experienced one partial and one complete immersion in the Flint River while fishing. About the time she entered the hospital, several rats discovered in her kitchen and attic were trapped and destroyed. The patient had also had contact with two dogs, but serums from both animals showed titers to *L. pomona* and *L. autumnalis*.

Table 3. Results of agglutination tests on serum from 16 animals infected with LT117

Animal No.	Species	Date collected	County	Antigens					
				LT117	Sari	Szwajizak	Kabura	Jules	Hebdomadis
		1956							
LT117	Raccoon	March 19	Baker	—	—	—	—	—	—
LT138	do	June 6	Dougherty	—	±50	—	—		
LT146	do	July 12	Seminole	—	±50	—	—		
LT153	do	December 5 [1]	do	—	—	—	—	—	—
LT179	Opossum	October 24	Calhoun	—	±50	—	—		
LT185	Raccoon	October 30	do	—	—	—	—		
LT186	do	October 31	do	800	400	200	400	400	800
LT188	do	November 1	do	50	±50	—			
LT196	do	November 7	do	50	±50	—	—		
N–196	do	November 8	do	800					
LT222	do	October 19	do	—	—	—	50		
		1957							
LT224	Opossum	January 10	Dougherty	400	800	200	100		
LT250	do	January 30	do	100	400	—	200		
LT252	Raccoon	January 30	do	100	—	—	—		
LT259	Striped skunk	February 20	Calhoun	±50	200	—	—		
LT282	Opossum	May 17	Dougherty	800					

[1] Received culture.

NOTE: — indicates no reaction in 1:50 dilution.

A third serum sample taken from the patient 2½ months after onset of illness showed a titer of 1:200 to both LT117 and *L. sejroe* antigens. After absorption with LT117 cells, this serum showed no reaction with LT117 or *L. sejroe* antigen but absorption with *L. sejroe* only reduced the original titer of LT117 by 50 percent. This serologic evidence together with the clinical and epidemiological history is at least suggestive of human infection with LT117. More recently, the infectivity of *L. mini georgia* for man was conclusively demonstrated through an accidental infection that occurred in another laboratory. This infection is reported by Goley and co-workers on pages 922–924.

Summary

A new strain of leptospires belonging to the hebdomadis serogroup is described. This strain is represented by 20 isolates from raccoons, opossums, and a striped skunk. Cross agglutinin-absorption studies indicate that the new strain is a subserotype of *L. mini*, and the designation *L. mini georgia* is proposed.

Agglutination tests with serum from 16 of 20 animals revealed antibodies against LT117, Sari, Szwajizak, or *kabura* antigen in 10 animals.

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A CASE OF HUMAN INFECTION WITH LEPTOSPIRA MINI GEORGIA

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A. D. Alexander, M.S.
J. F. Thiel, B.A.
V. E. Chappell, B.S.

Leptospira mini, subserotype *georgia*, was first isolated from the kidney of a raccoon trapped in Georgia in 1956. This serotype is related to members of the hebdomadis group and has repeatedly been demonstrated in naturally occurring infections in raccoons and opossums. Results of a study of leptospires isolated from these animals are reported on pages 917–921. However, the infectivity of this antigenic type for man or domestic animals has never been established. A case of infection in man with *L. mini georgia* incurred through a laboratory accident is presented.

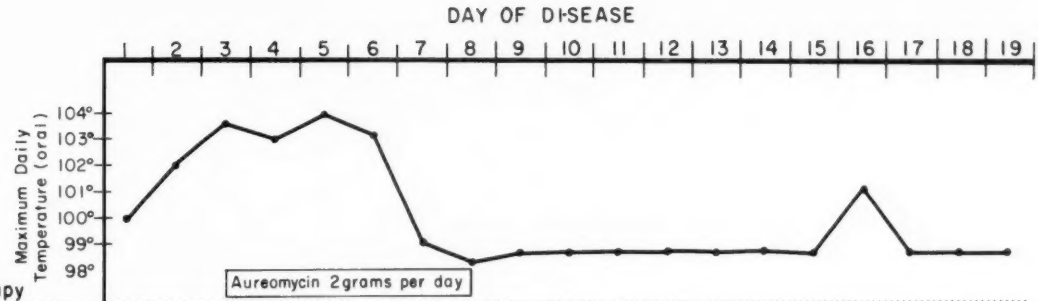
Case Report

A 53-year-old white male bacteriologist of the Veterinary Division of Walter Reed Army Institute of Research was apparently well until February 11, 1959, when he accidentally pricked his finger with a needle in the course of injecting rabbits with a culture of *L. mini georgia*. He immediately expressed blood from the wound and cleansed it with alcohol. He felt well for 25 days, then on the night of March 8, 1959, he had a sudden onset of chilliness, followed by fever and a severe frontal headache. During the next 36 hours he developed generalized muscular aching and mild nausea. He continued to have chills every 2 or 3 hours, and his temperature rose to 103.4° F.

He was first seen on the second day of illness. At this time he was found to be a well-developed, moderately obese man who appeared acutely ill. His temperature was 103° F., pulse 100, blood pressure 138/85. His chest was clear and there were no palpable nodes. He had no scleral icterus, conjunctival injection, nuchal rigidity, hepatic tenderness, or rash. Laboratory studies were made, and he was given aureomycin, 500 mg. orally, every 6 hours. During the next 48 hours his symptoms continued, and his physical findings remained unchanged except for the appearance of mild conjunctival suffusion. On the night of the sixth day of illness his fever dropped by crisis, and his headache and nausea disappeared. His only complaint for the next 10 days was weakness; however, on March 23, he had a recurrence of fever, malaise, and nausea. This subsided after 24 hours and he continued to improve. Convalescence was characterized by weakness but was otherwise uneventful. He returned to work 28 days after the onset of his illness.

At no time during his illness was there hepatic enlargement or tenderness. There was no evidence of meningeal involvement. He had no history of exposure to animals outside of the laboratory, and none of the other members of his family became ill.

Dr. Goley is with the Yale School of Medicine, New Haven, Conn. He was formerly with the Department of Bacteriology, Division of Communicable Diseases, Walter Reed Army Institute of Research, Washington, D.C. Mr. Alexander is with the institute's Department of Veterinary Bacteriology; Mr. Thiel and Mr. Chappell were formerly with that department. Mr. Thiel is now with the Laboratory of Viral Products, National Institutes of Health, Public Health Service, and Mr. Chappell is a student at the University of Illinois, department of animal sciences, Urbana.



Antibiotic Therapy																	
Blood Culture	+	+	+	+				–		–					–		
Agglutination titer with *L. mini georgia*	Neg.	Neg.	Neg.	Neg.				1:100		1:100					1:400		
Hemoglobin				13.4				13.4		13.0					13.0		
Sedimentation Rate (corr.)				45				38		37					5		
White Count				3,500				4,100		6,300					5,800		
Neutrophiles				82%				57%		47%					42%		
Lymphocytes				14%				33%		49%					50%		
Monocytes				4%				6%		3%					5%		
Eosinophiles								4%		1%					3%		
Urine:																	
Protein				3+		Trace		Trace		0	0	0	0	0	0		
Red Cells				6–10		0–3		Rare		Rare	0	0	0	0	0		
Culture				Neg.		Neg.				Neg.		Neg.			Neg.		
BUN															14		
Total Bilirubin				0.4				1.2							0.2		
Direct Bilirubin				0.2				0.2							0.0		
Thymol Turbidity				0				3 Units							2 Units		
Cephalin Flocculation				1+				1+							4+		

Laboratory Findings

The temperature curve and laboratory findings are summarized in the accompanying chart. The leucopenia during the acute phase of the disease should be noted. The albuminuria and hematuria might reflect minimal renal involvement; however, repeated urine cultures failed to demonstrate leptospires.

L. mini georgia was recovered by blood culture in Fletcher's medium from the second through the fifth day of disease. This occurred on two occasions in spite of aureomycin blood levels of 1.28 μg./ml. Hamsters and guinea pigs inoculated with the patient's blood developed no evident disease; however, the organism was recovered on culture of their blood and kidneys. Microagglutinations conducted with the isolated organism showed it to be identical to the one involved in the laboratory accident, and convalescent titers of 1:400 to both his own strain and the standard laboratory strain of *L. mini georgia* left no doubt concerning the etiology of his disease.

Comments

This case demonstrates that it is possible to infect man and produce overt disease with *L. mini georgia*. The clinical picture closely resembled what is commonly called flu or la grippe, and if the history of a laboratory accident had not been documented the diagnosis might well have been missed. It is probable that this type of clinical picture with leptospirosis is much more common than is generally recognized.

The incubation period of 25 days was well defined and, when compared with the previously established incubation periods of 2 to 19 days (*1*), was inordinately long.

Although leucocytosis is the usual finding in Weil's disease, leucopenia has been reported in less severe leptospiral infections (*2*). Thus, the finding of leucopenia in this case is not unusual. Similarly, it has been noted frequently that cases of leptospirosis may have a recurrence of fever during the third week of illness (*3*).

The efficacy of antibiotic therapy in leptospirosis is undecided (*4*). Several authors feel

that it exerts a favorable effect, particularly if given early in the course of disease (*5–8*). However, other studies seem to indicate that none of the commonly employed antibiotics are particularly effective in leptospirosis (*9, 10*), but because of the variability of severity of these infections any form of therapy is difficult to evaluate. In our patient, aureomycin in the dosage used failed to arrest the bacteremia, but we, of course, do not know if the therapy altered the course of the disease.

Summary

A laboratory infection with *L. mini georgia*, a new subserotype of the hebdomadis group, is reported. After an unusually long incubation period the disease was characterized by fever, frontal headache, and myalgia. Aureomycin therapy failed to eliminate the bacteremia. The similarity of mild leptospirosis to la grippe is noted.

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New PHS Divisions in Reorganization

The first major move in the Public Health Service reorganization recommended by a task force appointed by the Surgeon General establishes four new divisions in the Bureau of State Services.

The change, effective September 1, 1960, assigns all air pollution work to a Division of Air Pollution headed by Vernon G. MacKenzie, a career engineer officer active in air pollution control for the past 10 years. Dr. Richard A. Prindle, a physician who has been a specialist in health aspects of air pollution and chief of the Service's air pollution medical program for the last 2 years, is the deputy chief of the new division.

Occupational health activities are concentrated in a new Division of Occupational Health, with Dr. Harold J. Magnuson its chief. Dr. Magnuson has directed the Service's program in this field during the past 4 years. The action increases the potential for more funds and manpower for research on new chemicals and other industrial products and on development of safeguards for workers exposed to them. Such study contributes indirectly to protecting the public from new environmental health hazards.

A Division of Nursing, with Margaret Arnstein, a career nurse officer as chief, merges the former Division of Public Health Nursing and the Division of Nursing Resources. The new Division of Dental Public Health and Resources, headed by Dr. Donald J. Galagan, a career dental officer, combines the Division of Dental Public Health and the Division of Dental Resources.

LEPTOSPIRA POMONA INFECTION IN A WOODCHUCK PRELIMINARY REPORT

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Joseph I. Kresse, B.S.
Robert R. Marshak, D.V.M.
Charles J. Hollister, D.V.M.

In an epizootiological study of leptospirosis and brucellosis in cattle and wildlife in Chester County, Pa., *Leptospira pomona* was isolated from a southeastern woodchuck, *Marmota monax monax* (*1*). This was the first time *L. pomona* had been isolated from this species in the United States. Infection with *L. pomona* is common among cattle in southeastern Pennsylvania.

Materials and Methods

Kidney and urine specimens were removed aseptically. The kidney was ground with mortar and pestle and a 10 percent by volume suspension was made with Stuart's base liquid medium (Difco). The following media were employed: Fletcher's semisolid medium (Difco) containing 10 percent rabbit serum; Fletcher's semisolid medium containing 15 percent horse serum; Chang's semisolid medium (*2*), Hamilton, Mont., modification (*3*), containing 10 percent rabbit serum; Chang's semisolid medium containing 15 percent horse serum; and Stuart's semisolid medium (*4*) containing 10 percent rabbit serum. One set of media tubes was inoculated with 2–3 drops of kidney suspension and one set was inoculated with 1–2 drops of urine. Serial tenfold dilutions of kidney suspension were then made, with Stuart's base liquid medium, to approximate 10^{-2}, 10^{-3}, and 10^{-4} final dilutions. A 0.1-cc. inoculum of each of these dilutions was streaked on petri plates containing 30–35 cc. of Cox's (*5*) plate medium. Tubes and plates were incubated at 29° C. and examined at 7- to 10-day intervals. As the woodchuck was dead when delivered to our laboratory, it was not possible to determine the level of serum antibody.

The authors are all with the School of Veterinary Medicine, University of Pennsylvania, Philadelphia. Dr. Clark and Mr. Kresse are on assignment from Laboratory Services, Animal Disease Eradication Division, Agricultural Research Service, U.S. Department of Agriculture.

Results

Growth of *L. pomona* was detected on the 14th day postinoculation. Organisms were present in one tube of Fletcher's semisolid medium with 10 percent rabbit serum inoculated with kidney tissue and in Fletcher's semisolid medium with 15 percent horse serum and Chang's semisolid medium with 10 percent rabbit serum inoculated with urine. Transfers of organisms were made into Fletcher's semisolid medium with 10 percent rabbit serum and subcultures were made at 30- to 40-day intervals. Cultures were sent to the WHO Reference Laboratory for Leptospirosis, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D.C., for typing, where the organisms were identified as *L. pomona*.

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The Public Be Informed!

There is a distinction between publicity and reporting which I find is often completely unappreciated by scientists and businessmen alike. I am sure that the public relations people and reporters themselves are keenly aware of the difference. The reporter, the science writer, usually a full-time member of a press association or a newspaper staff, has a duty to be skeptical, questioning, inquiring, and to ferret out the hidden motives, the greed, the inconsistencies, and the purposefully or inadvertently slanted viewpoints. His is a service to the public. The person engaging in public relations is, on the other hand, hired by and answerable to a concern or a person who wants to get something into public print. He may work for an advertising agency, or he may work directly for a corporation, or, in these enlightened days, for research laboratories and scientific institutions.

Most of the public relations people have the high qualifications and, within their framework, the ethics of the best science writers. Many of them, of course, have been science writers and reporters for newspapers, and they have come into the work of public relations through that avenue. But it is important to realize that they are working for a person or institution that wants to get something into the newspapers. If their employers want something in the papers, it is the job of the public relations person to do his best to get it in, whether he is wholeheartedly in favor of it or not. That is his job. So you see that a person doing publicity must operate in a somewhat different way with different criteria from the science writers who are primarily interested in the way in which the public is informed.

If more scientists understood this distinction, recognized it, and applauded it, we would undoubtedly have better reporting of science. Strangely, the same scientists who would be appalled at slanting research results often assume that anybody who is writing for newspapers, particularly when handling their research reports, should take a public relations attitude toward them. This distinction between publicity and reporting is extremely important, and scientists should be reminded periodically.

I do not mean to imply that public relations efforts should not be undertaken or that the press agents, as they used to be called, do not serve a useful function.

The superior financial reward that comes to those who do publicity rather than reporting should be a matter of concern to those interested in the distribution of scientific information and opinion to the public through mass media. Repeatedly, those who have become experts in science writing and reporting cannot resist the temptation of considerably higher salaries obtainable from those who wish to have adequate public relations efforts.

Not all of the science writers are happier in writing for direct publication itself, through newspapers, magazines, and the like, but I believe most of them would prefer to do this than to do public relations. The deterrent to holding many of the best of the science writers in actual writing for newspapers and magazines is often the salary differential.

Another concern in the training, raising, nurturing, and feeding of science writers, particularly those who are beginning, consists of very different criteria for science writing than some of us, some four decades ago, hoped might exist. The plain fact is that many science writers now just do not know anything fundamentally about science, or at least they did not when they started in. I have had the conviction that a good science writer ought to be a hybrid, part scientist and part newspaperman, and to achieve this effective blend, it would be better to start off as a scientist of sorts rather than as a newspaper person. While many of the judgments of the good reporter are those of a good research person, that is, both must assay facts, draw conclusions, and have high integrity and a willingness to recede from preconceived notions, nevertheless in practice the research method is somewhat different, although not fundamentally, from the journalistic method. Every person who expects to make science writing a career really should get his hands dirty and his mind disturbed in some sort of a research laboratory.—*Excerpt from an address by Watson Davis, director, Science Service, when accepting the James T. Grady Medal for excellence in science writing, presented by the American Chemical Society, Cleveland, Ohio, April 7, 1960.*

WEB OF MUTUAL ANTICIPATIONS

CONFERENCE REPORT

The dynamics of education for health, theme of the 1960 Eastern States Health Education Conference at the New York Academy of Medicine, April 28 and 29, deliberately distinguished between health education and education for health.

From the opening remarks by the conference chairman, Dr. Duncan W. Clark, State University of New York, to the summary by Dr. Iago Galdston, The New York Academy of Medicine, the discussions dwelt on the value of self-conscious consideration of communication as art or science, in both general and specific terms, as a phase of the social process. Most of the speakers were sociologists.

Quoting the observation of Joseph Coffman of Holyoke, Mass., that "the greatest barrier to communication is the illusion that it has been achieved," Dr. Galdston stated the goals for the conference: first, to outline the complex phenomena of communication in relation to learning; second, to relate the techniques of communication to public health needs; and, finally, to show how changing technologies affect both communications and health programs.

Research Opportunities

Following references by Dr. Galdston to such aspects of communication as linguistics, semantics, subliminal imprinting, and nonverbal communication, Prof. John W. Riley, Jr., explained why a simple model of communication, "who says what, in what channels, to whom with what effect," needs to be modified into something like "a network of mutual expectations which binds together social entities."

As an example of the unanticipated consequences of communication, he mentioned a survey during the last New York newspaper strike, which concluded that most people bought papers not for information but to achieve "a sense of security in a disturbed world."

Similar findings were reported with respect

to the audiences of daytime radio and TV serials.

The tendency for people to hear only what they wish to hear, Riley said, was illustrated by evidence that so many who attended lectures or films on the dangers of inflation already knew the message.

Other evidence of this tendency, he said, is found in studies of perception: for example, one found that poor children always overestimate the size of coins.

Riley also reported that children who are accepted by their peers usually have little difficulty in absorbing traumatic experiences: it is the children who feel they do not belong who act out their feelings.

The major determination in the field of communication, he reported, is that individual behavior and opinion seem to be shaped above all by membership in a primary group, often a neighborhood. What will the neighbors think, appears to be the strongest single influence.

The public, Riley observed, is not an anonymous aggregate of unrelated individuals but a mosaic of interlocking social units, with key figures in each setting the pattern for their peers.

Professor Riley primarily stressed the need to think objectively about communications and to study the phenomena.

Categorically, he recommended research in the social processes of communication, with studies of perception, reference groups, primary groups, and small groups.

Knowledge for What?

Dr. Herbert E. Krugman, director of market research for Raymond Loewy Associates, described studies of communication which likened a message to the infectious agent in the classical epidemiological setting of host, agent, and environment. Among studies conducted with reference to psychological warfare, efforts were directed at learning how long it takes before a message dropped from a plane becomes a topic of conversation in enemy territory. Another experiment was aimed at appraising the public mood simply by reporting random remarks heard in the pubs and markets of England.

As a result of market research, he explained, most commercial advertising is directed not at selling a product but at selling a convenience or service, or at some other interest of the audience: specific information about the product per se is usually the last thing the consumer evaluates, he indicated.

In this connection, he raised an ethical issue with respect to the fetish of being well informed. Under the spell of certain advertising, Krugman said, people tend to assume they have fulfilled a civic responsibility simply by coming into possession of a wealth of facts; they feel no duty to act upon the information. Information itself, he stressed, is not enough. It may be a handicap to action if informed people lose a sense of guilt for not acting.

Krugman then described a model developed at the University of Michigan in a study to trace the relation between action and channels of information. Five stages of public response, defined as awareness, interests, evaluation, trial, and adoption, were related to the source of information at that stage. As might be expected, the mass media, predominantly newspapers and broadcasting, were mentioned most prominently at the stage of awareness, but even then by only about half of the respondents. The emphasis on mass media thereafter declined until at the stage of adoption they were not mentioned at all.

Mass Media

The secondary effect of the mass media as an influence on the key persons who provided the final influences was a complicating factor in this model. Krugman concluded there is no priority among the types of communications used. Each is appropriate to its own function. Strong publicity, he said, cannot compensate for a weak field service, and a field service is not fully effective without publicity.

The first persons to respond to a message, Krugman emphasized, are the most important to the program. Failure to deal with them properly at this stage, he said, handicaps a program at the outset. He strongly endorsed field trials as a basis for preparing techniques for mass application.

The phasing of a program, he said, should allow not only for the tactical use of media but

also for a change of pace, so that slow movers may be picked up after they have been passed by in early stages. For example, an immunization campaign might succeed in bringing half the population into a clinic on the first announcement, but other sustained and paced methods will be needed to immunize the others. While the rapid processing unit may move on to another center, personal visits or telephone calls may be applied to complete the program.

By anticipating tension and resistance in the slow movers, he said, the agency can learn the nature of the resistance and deal with it. If the objective is to persuade young people not to smoke, Krugman suggested it is useful to know that they regard smoking as a mark of adult behavior, as an exciting element of living, and as a minor hazard which, in their judgment, will surely be overcome by scientific advances.

Resistance

Resistance, he said, is seldom open or direct, but rather an uneasy and defensive conflict, with more variations than there are human beings. In effect, he said, the technique of overcoming resistance remains an art, rather than a science.

The personal aspect of communication, the bridge between the mass message and specific action, Krugman stated, is the most difficult to effect, most crucial, and most in need of evaluation during an operation, so that the word-of-mouth response may be effectively observed.

The models described by the other speakers as a skeleton of discussion were complicated further by Dr. Robert O. Carlson, communications research adviser to Standard Oil Company (N.J.). Distinguishing between the committed audience and the uncommitted audience, he devoted most of his attention to the image which the audience has of the public health agency. This image, he said, may account for resistance among the uncommitted.

Communication with a committed audience, such as a gathering of campaign workers, has the value, he said, of reinforcing established values or information. Its challenges are mild compared with those of the uncommitted who if not openly hostile are probably apathetic to the message.

The Uncommitted Audience

Typically, he said, the uncommitted audience considers a health agency as interested only in the poor. It endows the health agency with a "welfare halo," seeing it as a symbol of authority, as a patronizing force, impersonally concerned with statistical measurement rather than with human beings. It is usual for the uncommitted audience to believe that the health agency is "simply trying to scare the people." Or the audience may respond indifferently to the message, saying, "I know it already," or "It's too technical for me." The audience may feel the health agency is intruding on personal affairs or engaging in a fund-raising racket. The resistance may be based on simple xenophobia: "I don't know you: go away." Whether or not these aspects of resistance are superficial or rationalizations, Carlson considers them typical.

On the other hand, the uncommitted audience is impressed by a message from a source respected by the leader of the primary group. But it will not swallow a statement in conflict with its expectations from that source: it would be dubious of a health officer's endorsement of a beauty cream. Credibility is influenced by the image of the source as an expert on values or as an expert on facts or technology. The city engineer might be heeded with respect to the quantities of water required by a city, but not for his opinion on health insurance.

The motives of the source of information are always questioned, but openly acknowledged self-interest, Carlson noted, is usually disarming, as in the case of the successful candidate for office who freely admitted he wanted the job because he needed the money. It is better for motives to be explicit, he said, than hidden.

Essential to the success of a message, said Carlson, is a set of common values. No communication will succeed if the audience and the source have no common ground to stand on.

Equally essential, he said, is the need for deeds to be congruent with words, as when the Surgeon General led off an immunization program by inoculating his own children.

The Self Image

The image of self, said Carlson, is as important in behavior as the image of the source

of information. Dr. Edward A. Suchman, director of social science activities for the New York City Health Department, commented that the self-image bears especially upon health educators and others engaged in public communications. If instead of analyzing a situation objectively, a person fits events into a conception of his own role, his behavior becomes routinized and ritualistic rather than rational.

Such behavior, he said, is not a product of conformity or a symptom of a lack of imagination, but the end product of a process of socialization. Along with other speakers, Suchman referred to the oft-quoted remark of Samuel Darling, "to learn how to control malaria, you have to think like a mosquito."

Because of the tendency to conform to a self-imposed pattern, Suchman remarked that 95 percent of the presidential vote in some groups is predictable. This identification with the primary group, and acceptance of its mission, he added, rather than an intellectual grasp of the issues, was the deciding factor in the fighting spirit of the Armed Forces during the war.

Conversely, prejudiced persons do not see themselves as bigots, he said, and for this reason messages of liberalism are dismissed as inapplicable by those most in need of it.

Seeing herself as a good mother, he added, a woman takes her child to be vaccinated, not because she understands the risks and percentages of protection, but because that is what good mothers do.

Basic Rules

Four sociological rules were put forth by Suchman in summation.

First, he dwelt on the point that there is no single public, but a four-dimensional mosaic of many groups with differing characteristics. When a message helps an individual to identify himself with a group to which he feels attached, Suchman said, it is easier to deal with the individual. The differences among groups which influence behavior were illustrated by his observing that 60 percent of working class mothers, according to one study, fed children at the breast, whereas only 25 percent of middle class mothers followed the practice, at that time. (Since then, he conceded, fashions may have changed.)

Second, he emphasized that the message itself is only a small factor in the total system of communications, as indicated by the many cultural and physical influences which bear on behavior. Any communication will be fitted into an already existing group definition of the situation.

Third, he stated that there is seldom a consistency between the facts on the one hand and attitudes or behavior on the other, or between attitudes and behavior. Eating habits, for example, may be determined by medical advice, kitchen facilities, or finances, rather than by attitudes. Whatever may be the relevant scientific facts, he said, attitudes are determined by emotions and custom, and behavior is governed by legality, environment, and habit.

Fourth, while it is seldom possible for a message to reach the bulk of a population directly, Suchman said, the masses can be reached through their leaders. While most people are psychologically deaf to a scientific message, they tend to go along with leaders who look at the facts, listen to the arguments, and pass on their conclusions. These gatekeepers of the channels of communication often may be reached through mass media, he said, but it is always important to know who they are and how to reach them.

Dr. Henry B. Makover, professor of preventive medicine, Albert Einstein College of Medicine, endeavored to analyze the deficiencies in public health practice relative to communications.

While it seems self-evident that public health agencies have the information to improve conditions, he said, their campaigns are sometimes misguided, wasteful, or even destructive. First of all, he said, the objectives of a program must be clear to the professions and desirable to the public, and such conditions are not readily fulfilled.

Criteria

Makover suggested that health programs might be appraised for congruence, relevance, and evaluation. By congruence, he implied the quality of mutuality of purpose between the profession and the community. The profession which is concerned wholly with the presence of pathogens in water, for example, is not congruent with a public which, he said, is concerned

with the recreational and aesthetic values of the open stream. Even a common language employed by both the professional and the public does not guarantee a common purpose.

The relevance of a program, he suggested, is indicated by its consistency with the prevailing mode of possibilities. For example, he said, if a heart patient lives on the third floor of a walkup tenement, it is congruent to advise against climbing stairs, but it is not relevant. Even if the need is understood, the application of prescribed action may be irrelevant. For example, the urban environment, he said, is ill suited to the usual recommendations for the wise use of leisure time.

The quality of a program's evaluation, Makover said, is determined by the feedback of relevant information. In this connection, he deplored the personnel shortages which encourage a physician to seek a diagnosis by the "laying on of hands" and from laboratory reports, rather than undertake a careful solicitation of history. He asked why it is that the sound of a heart, heard through a stethoscope, is considered more scientific than the sounds that issue from the mouth.

He cited the highway safety program as an example of congruence, with good evaluation, but a deplorable lack of relevance, since speed and social status command a higher premium than safety.

Ecology

With a glance at the past achievements in public health as an inspiration to the future, Dr. Wilson G. Smillie, professor emeritus of Cornell University, reminded his audience that many great leaders of public health movements in the 19th century were not trained in the health professions but were lay figures such as Dorothea Lynde Dix, Lemuel Shattuck, Florence Nightingale, Nathan Straus, and Edwin Chadwick.

Their prominence, he suggested, indicated a vigorous public knowledge of and interest in health issues related to free communication between the professions and the public.

Following a further historical review of the changing and expanding character of public health presented by Dr. George Rosen, professor of health education, Columbia University, Dr. Jay Tepperman, professor of experimental medicine, State University of New York, Syracuse, discussed the nature of health needs of the present era. Whereas the bacteriological developments in public health, following development of the achromatic microscope, presented a fairly simple model of action, Tepperman pointed out that the health needs of modern times are complicated by a mosaic of factors: genetic, environmental, nutritional, psychological, social, dietary, economic, cultural, and even religious.

As Rosen said in his presentation, the concept of public health was narrowed by the specificity of the germ theory, but broadened again as the human element and the socioeconomic forces came into focus, so that the attempt today is to see public health from the point of view of the ecologist.

Citing Pasteur as personifying the specific approach on the one hand and Bernard as the holistic or physiological approach on the other, Tepperman proceeded to discuss the role of the experimental animal in the collection and dissemination of information pertinent to health.

Lesson of the Rat

Whereas acute infections are vulnerable to any attack which breaks the life cycle of the specific agent, he observed that the chronic diseases are not so readily understood or controlled, being generally multifactorial, that is, associated with a mosaic of influences. It is seldom clear that one plan or another will bring an anticipated result. This condition is not only perplexing to the scientist but even more confusing to the journalist and the general reader, because so little valid information about physiology can be conveyed in a headline or a radio bulletin.

Although it is not easy to learn the nature of physiology even in general terms, Tepperman said, public understanding of the individual role in relation to chronic diseases can be achieved in no other way. It is only unfortunate, he commented, that some of the solutions of our present health problems will not necessarily come in bottles.

The experimental animal, he said, has helped to explain both to the clinician and the theoretician the interplay of the variables in complex biological processes. To illustrate, he described some of his own work with respect to coronary occlusions.

Although epidemiological studies of bus drivers and conductors and of postmen and male telephone operators, he said, have indicated that active workers are less likely to suffer coronary attacks than sedentary workers, there were no satisfactory physiological data to explain this phenomenon. In an effort to discover how exercise affected the heart, Tepperman divided a group of homogeneous rats into two categories. One lot was encouraged to swim for 1 hour each day, with special efforts to activate floaters and piggyback riders. The other lot, under identical housing and feeding conditions, was permitted to rest.

The physiological effects of this experiment were revealed as Tepperman next showed a few slides depicting a technique, critical to the experiment, for measuring the diameter of the coronary vessels in the respective rat groups. A liquid red plastic compound was injected into each rat's beating heart so that the fluid was pumped through the entire coronary system. There it hardened. When the meat of the heart was removed in an alkaline solution, the plastic residue formed an exquisite model of the blood vessels. These models then were measured in relation to the mass of the heart.

In the swimming rats, the coronary artery network was found to be consistently of higher volumetric ratio to the mass of heart muscle than in nonswimmers. Also, the collateral branching of the coronary artery network was larger and more elaborate. Although the rats which had been encouraged to swim developed, during the experimental period, massively larger hearts, their heart-bulk regressed if they were allowed to rest a given period before sacrifice. But after the resting period, the coronary artery network of the exercised rat retained a higher volumetric ratio to its muscle bulk.

While exercise is only one item in the complex which includes diet, emotional stress, smoking habits, endocrine activity, and geographical position among other factors, the experiment demonstrated a mechanism which may relate exercise to a low incidence of coronary occlusion.

For the purpose of the conference, which was not primarily concerned with heart disease, the chairman observed that Dr. Tepperman also demonstrated a method of communicating effectively, by using narrative with humor, visual aids, and real events described in concrete terms.

An Obligation and a Right

Speaking at the dinner meeting, Dr. John D. Porterfield, Deputy Surgeon General, Public Health Service, laid to limited resources of manpower and other health facilities the failure of health workers to utilize available knowledge. While some of the lag between knowledge and its application is unavoidable, he said, and some even desirable, he felt that behind the failure to obtain support for health programs was a deficiency in public education. There can be little doubt, he said, that we have largely failed to convey to the public the enormous returns on its rather modest investment in health. Stressing that the public health agency is accountable for its actions, he added that there is both an obligation and a right to improve public knowledge of health services, so that the public may form wise decisions.

Porterfield challenged the profession to be both bold and flexible in utilizing the media of communications, but also to be mindful of limitations of the mass media in dealing with complex issues and of the limitations of the behavioral sciences in guiding a course of administrative action. In support of an aggressive strategy, he reminded his audience that the successes of the past were won because the leaders saw clearly what they wished to accomplish and they enlisted public support in the fight for health. This determination and vision, coupled with an ability to speak and write with words the public understands, Porterfield suggested, was not a magic formula, but certainly desirable.

Full text of the conference talks and discussions will be published by the New York Academy of Medicine.

The Elements of Health Education in Good Public Health Programs

GRANVILLE W. LARIMORE, M.D.

AS THEMES, the elements of a good public health education program, or what public health education can contribute to a good public health program, are fields of discussion which have been virtually tilled to exhaustion. In contrast, our colleagues in Pennsylvania have taken a completely fresh approach. Instead of looking at public health through the eyes of health education, they have proposed to turn around and examine health education from the broad perspective of public health.

Yet another aspect of this approach is the assumption that a good public health program does have at least some elements of education built into it. This assumption is one about which I hope there will be little controversy.

The objective of any good public health program is a favorable effect on the health status of the citizens of a community, whether that community is a municipality, a State, a nation or, for that matter, the world. Such an objective, by its nature, implies change, except in rare circumstances when perfection is to be maintained. Almost without exception, accomplishing this objective requires some intended changes of attitude and behavior among those affected. This premise applies as much to yaws control deep in Africa as to our own efforts to vaccinate against poliomyelitis.

Since an intentional change of attitudes, beliefs, and behavior is, I believe admittedly, inherent in a good public health program, we may then ask, what process is chiefly instrumental in bringing this about? Through the techniques of education, which include study, communication, and demonstration, we seek to impart health information and at the same time motivate the individual to use that information for the protection of his health.

To see this process for what it is and to improve it is the hope of every director of public health.

Most of us in public health have some familiarity with educational principles; either through formal training or from day-to-day experience. I suspect that there is hardly a public health program launched today which does not at least give lip service to "public health education."

But how many programs allow for the thought, the time, and the facilities for their educational phase? How many introduce the educational function at the beginning and keep it bound to the core of the program until the end? Is there a seat at the table for this function at the first planning session? Is it occupied by someone especially qualified by experience and training, with knowledge of the program both at the giving and receiving end, with sense and judgment in the realm of science, the social sciences, and public health practice, with skills in communication and organization? Although education is a function shared by all members of a health agency, wise health directors, when they can, employ the services of a specialist in this function, even as they employ specialists in pathology, nursing, engineering, and statistics.

Especially with respect to short-term pro-

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grams, successful programs rely on three elements of education. The first is communication.

Many public health programs have faltered through neglect of communications. Sometimes the staff themselves are ill-informed about the program, its objectives, and how it is to be carried out. It is not unusual for staff members to say, "I don't know anything about it; I just work here; nobody ever tells me anything." The remark, often passed half in jest, half in bitterness, reflects a breakdown of communications that can easily be met by meetings and written outlines. In some agencies, it is met in the process of preparing program descriptions and progress reports by staff members.

From this beginning, the chain of communication extends to all others directly concerned. Depending on the nature of the program, they include key people in institutions and organizations, such as voluntary and official health agencies, professional societies such as those of medicine, nursing, and engineering, the schools, and civic groups. It is a truism that public information is meant not for a single audience but for a mosaic of audiences. There is really not a "general" public, but many smaller "individual" publics.

Communications with these audiences, however complete and thorough, are successful to the degree that they are arranged to reach the respective audiences in proper sequence and at an effective time. In a poliomyelitis vaccination program, for example, communications are timed to reach physicians before they do lay groups, and they may go to medical leaders before they go to the medical society as a whole. By such means, understanding and cooperation may develop systematically.

The communications process has its genesis in the joint planning that accompanies the development of any public health program. Properly carried out, such joint planning brings to the conference table representation from all the groups who will have an active role in the program, as well as those who will be reached by the program. These conferences are in themselves a phase of communication, which is by definition a two-way flow of information.

The second element of education is the substance of the "information" itself, especially that which goes out rather than what comes in. If it be desired that the maximum number of individuals in the community learn about the program, the need for it, and the reasons for the course of action recommended, the most practical course is to supply the facts through newspapers, radio, television, and other mass media. The technique applies when it is desirable to disseminate information about the program accurately, quickly, and to the largest audience possible.

The third element, supplementing communication to the general public, seeks participation of a multitude of social units. This element is usually called community organization. These social units each have their own core: a neighborhood, a church, a lodge, a profession, trade, business, or civic interest, a school, ethnic background, a sporting interest, a hobby, or a cause. The specialist studies the community's structure to search out these discrete groups and their organizational structure, so as to develop effective lines of communication with their members. In so doing, the information process extends from the mass media to a specialized and personal relation with each group.

It is an axiom that the mere possession or transmission of information is not the ultimate objective. Information, unless acted upon, is of only academic interest. From the efforts to put information to use comes the term "community involvement," expressive of the aim actually to involve social units and their members in the program.

Why is involvement an essential element of the process of education? First, it is generally accepted that involvement in the learning process strengthens that process. Second, involvement provides a motivating force. For example, when an organization devotes a meeting to a discussion of a health program, considers all aspects of it, pro and con, and takes a position on it, each member of the group becomes involved by being identified with the experience, reviewing the information, and assuming some emotional relation to the position voted. He is the more likely to develop an attitude or a course of behavior suggested by the unit than by independent experience.

Involvement may also take the form of volunteer service, in which members of the group assist with the program. Again, such involve-

ment provides a strong motivating force in changing attitudes and influencing behavior. Where one's work goes, so does one's interest. Given a fortunate experience, the volunteer learns the meaning and value of a program and becomes a staunch advocate and supporter. If his experience is unfortunate, of course, he may turn the more violently against it.

Finally, may we mention, not specifically as an element of the health education process but of prime importance nonetheless, one other factor. That is, the factor of "timing." We have already referred indirectly to timing in the sequential development of the communications process; now may we speak of it with respect to the community. It has been our observation that many public health programs have failed because of poor timing. Not only in the sense that the community was not yet ready for the program, but more particularly in the sense that timing is in itself important in the educational process.

For example, health agencies sometimes exhibit an unhappy tendency to move too fast in carrying out programs which require active participation on the part of individuals in the community. It appears quite clear that there is as definite an "incubation period" with respect to the lag between the time the community is informed and the community acts as there is between the time of exposure to a disease and the development of the first symptoms.

Even as this incubation period varies with individual diseases, so does it vary with different public health programs. It is to be noted that, for some diseases, this period is quite short. Similarly, in a real health emergency, we are all sometimes surprised how quickly a community becomes informed and how rapidly it responds. In general, however, there is a lag of weeks or even months between the informational and action phases of a public health program. Without proper timing of information in relation to action, the best laid public health programs go awry.

How fast one may move depends on the nature of the program, the size of the community, the structure of the community, and a number of other factors. The final decision as to timing must in the last analysis depend on judgment based in turn upon experience, a thorough knowledge of the factors involved, and a sensitive feeling for the responses of the public in each specific situation.

Summary

In summary, these assumptions are proposed for a working hypothesis:

1. That education of the staff, community leaders, and the public is essential to effective public health programs.
2. That public health programs are most likely to succeed to the extent that education is brought into the planning early and to the extent the specialists in education participate in the program planning.
3. That among the elements of education in a good public health program are (*a*) free and thorough communications, first within the agency itself and then with the individuals and groups especially affected or to be reached by the program; (*b*) detailed attention to the information process to the end that, when desirable, the community at large is informed through suitable mass media; (*c*) involvement of individuals in the community through the medium of the many social units which make up the general public.
4. That appreciation of the importance of timing will allow for a proper incubation period from the moment of the first information about the program until the hour for action.

Referee's Comments

In the past, there has been some controversy on the point that a health education program seeks "to motivate the individual . . . for the protection of his health." This controversy may be based on imaginary grounds.

It is possible to imagine an all-powerful government using base techniques to influence public behavior in a direction which its bureaucrats fondly believe is all for the best. It is not difficult to cite examples of governmental propaganda which, deliberately or not, has led a public to its own destruction.

On the other hand, it is almost impossible to conceive of a program of information which does not in one way or another imply an effort at motivation. If there were no effort at motivation, there would be no information.

The controversy therefore relates not to the existence of efforts to motivate society but to the nature of such efforts. However noble and altruistic the intent may be, it appears arrogant to assume a personal responsibility for seeing that others behave properly. Such arrogance, even as exercised by parents toward their children, arouses resentment and distrust. The question is, how can a health agency exercise responsibility without such arrogance?

An unemotional statement of the facts is as a rule an unimpeachable course. It is the course most public agencies seek to pursue, whether accounting to the public for their own expenditures, or advising the public of important news.

It may be argued that the facts on fluoridation, by themselves, have not always succeeded in overcoming emotional opposition. In such situations have public agencies fulfilled their responsibility? It may also be argued that the facts have seldom been presented so as to overcome legitimate doubts among the majority: the issue was permitted to be political rather than scientific.

An even more perplexing shortcoming in reliance upon simple fact concerns programs of radiation safety. In the absence of completely valid information which, for the moment, may decide the public course on a scientific basis, the issue of radioactive contamination has become almost wholly political. In this situation, how can unemotional information fulfill the health profession's responsibility? Is it sufficient to supplement unemotional fact with cold logic?

There is no intention here to claim that public behavior is on the whole determined either by facts or logic. Most behavior appears to be imitative and repetitive, or intuitive. Or it is influenced by a system of rewards and punishments, real or illusory. With such a pattern of public behavior, does a health agency abdicate responsibility when it confines education to fact and logic?

The escape from this corner appears to be an assumption that community leaders are influenced by fact and logic in a climate of knowledge and understanding, where their behavior may be understood to be rational. It may be further assumed that the response of the public, the mosaic of small publics, is to follow the leaders, even as children are more impressed by the example of their parents than by what their parents may tell them to do. The mass media, as noted above, are essential to creating a climate of knowledge and understanding: personal involvement will complete the work of fact and logic to suggest a course of action for the community leader.

The course may not be the course which the health profession looked for, but it will be one democratically determined by enlightened citizens.

Nobody deprecates legitimate efforts to bring facts and logic to public attention: the use of Monday datelines on press releases, colored ink, and eye-appealing layout and design of educational materials are all as legitimate in the tradition of communication as the Roman alphabet. The technique of presentation goes false, it seems, when logic is distorted, when irrelevant motives are abused, or when the facts themselves are twisted.

In the contemporary code of ethics, there seem to be no barriers to the half-truth, to the appeal to fear, libido, or status imagery; to the deadening of common sense by an inane repetition of a name or a slogan. But the resort to these devices in itself frustrates the objective of health. The healthy body implies a healthy mind. And a healthy mind is one that works, not one that is clouded with lies, base motives, or associations empty of meaning or value. For this reason, the techniques of motivation in a health program should tend to police themselves. And the controversy over the health agency's role in influencing behavior proves indeed to be imaginary.

The R. E. Dyer Lecture

IMMUNOFLUORESCENCE

ALBERT H. COONS, M.D.

IT IS a high honor to be invited to deliver the R. E. Dyer Lecture. Dr. Dyer was actively studying rickettsiae when I was still a college student. Tonight he sits among us in the midst of this galaxy of institutes of which he was the first director and the initial guiding force. We are all here to do him honor and I know we are all joined in wishing him many more happy anniversaries.

Such an occasion is both a challenge and a responsibility to the lecturer, and I feel humble under its weight. Up to the present, my activities have been increasingly specialized, so that there is little choice in the subjects of which I can claim sufficient expert knowledge to justify your coming to listen. I am a musician with a single tune; when I am called upon to sing, I must hope that the audience is new because, alas, the song is not. However, the subject of immunofluorescence is not out of place in this environment. Indeed both the cellular aspects of immune reactions and the specific identification of pathogens in smears are matters not only of obvious interest but of active advance within the Public Health Service. The fact is that, although my colleagues and I had a hand in introducing fluorescent antibodies as useful immunological reagents, the largest and most active group now working with them is at the Communicable Disease Center of the Public Health Service at Atlanta, Ga.

Fluorescent antibodies, whatever their scientific merits, are very attractive under the microscope. They shine in the dark, a brilliant greenish-yellow glow. Like pebbles in the moonlight, they weave a pattern in the forest which leads the weary children home.

In the space of an evening it is not possible to describe in detail the multiplying examples of the application of these labeled antibody molecules to the many special problems of infectious disease. Rather, I propose to describe briefly what fluorescent antibodies are and then to single out examples of their use: the specific identification of a virus and a bacterium in a diagnostic situation; the study of tissue cells infected with a virus; and the synthesis of antibody in cells.

Antibody molecules are proteins synthesized by cells apparently specialized for that process, and then secreted into the circulation, where they persist for a few weeks in gradually diminishing amounts. Their half-life in man is about 13 days, and in the animal most favored by immunologists, the rabbit, about 5 days (*1*). The special property which makes them objects of intense current interest is their possession, as structural features, of two specific reactive areas, apparently concave. They are complementary to and fit more or less snugly around molecular configurations projecting from the antigen molecule which stimulated their synthesis in the first place (*2,3*). These comple-

Dr. Coons, a career investigator of the American Heart Association and visiting professor of bacteriology and immunology at Harvard Medical School, delivered this lecture December 1, 1959, at the National Institutes of Health, Public Health Service.

mentary patches account for the specific interactions between the antigen and the antibody. For reasons not understood, the patches on a given antibody molecule apparently react with the same antigen molecule, and perhaps always with the same configuration, not with a different one. Since such antibodies appear in any appreciable amount only after exposure of the cells to the antigen, the mechanism of their synthesis is a fascinating and unsolved problem. I will come back to this later.

Meantime, regardless of the details of the method by which antibodies are synthesized in such exquisite complementary form, their specificity can be harnessed as a tool. The history of immunology is largely that of the utilization of antibodies, produced by systematic injection of an antigen into animals, for various specific purposes. Making them fluorescent is simply another variation of their use as reagents for the identification of specific antigen, whether it be vaccinia virus or hen's ovalbumin.

Fluorescent Antibodies

Let me describe briefly how one can make an antibody fluorescent. Under suitably alkaline conditions (pH 9.0) aromatic isocyanates will react with the free amino groups of protein molecules to form a urea-like linkage, a reaction introduced into immunology by Hopkins and Wormall in 1933 (*4*) and later used by Creech and Jones (*5*) to couple carcinogenic hydrocarbons to carrier proteins. After an initial demonstration that a reaction between anthracene isocyanate and rabbit antibody could be carried out without serious damage to the specificity of the antibody, Creech, Jones, Berliner, and I (*6*) demonstrated that antigen could be visualized in the phagocytic cells of the mouse by means of specific antibody labeled with fluorescein.

The choice of fluorescein has proved a happy one. Fluorescein was originally chosen because of the virtual absence of green fluorescing materials from mammalian tissue, and because of the brilliance of the greenish-yellow light which fluorescein emits. In fact, the quantum efficiency of fluorescein is reported to be about 75 percent (*7*). Moreover, although we did not think of it at the time, its emission wave length of 5,200 Å is very close to the maximum of retinal sensitivity (*8*). Recently, several new compounds have been successfully tried as labeling materials in order to provide more than one color for purposes of identification: rhodamine, orange-red (*9*) and dimethylaminonaphthyl sulfonic acid, yellow (*10*, *11*). The most recent advance in labeling was the introduction by Riggs and co-workers (*12*) of the isothiocyanate instead of the isocyanate (*13*). The isothiocyanates of fluorescein and of rhodamine are stable solids which can be added to buffered dilute antibody solutions and will react without need of organic solvents. They are commercially available and have put the labeling procedure into the hands of everyone.

Such labeled antibody solutions are the simple means of merging immunology and morphology; they bridge the gap between the world of the microscope and the world of immunological specificity. As such they give the specificity of antigen-antibody reactions to the cytologist, and add the microscope to the weapons of the serologist. Under favorable circumstances an enzyme can be precisely localized to a secretion granule (*14*) and a few bacterial cells identified in a large, mixed flora (*15*). The immunologist can study some of the reactions of antigen and antibody in vivo, for example, and look to see where injected antigen is concentrated and where the resulting antibody makes its first appearance.

The actual specificity of the reactions depends of course on the quality of the antibody solution. If it contains an unknown mixture of antibodies, the observations made with it will be uncertain. What one sees of such a specific reaction depends on the fact that antibody molecules, once reacted with specific antigen, cannot be dislodged by the saline used to rinse off the excess, unreacted molecules. The reliability of observations depends on the care with which control observations are carried out, and upon the appropriateness of their selection. Although this is not the place to describe or to mourn the technical details involved in the successful use of labeled antibody for tissue localization of a chosen antigen, it would be unfair not to mention that there are difficulties, sometimes almost insurmountable, due to interactions between fluorescent protein molecules in the

antibody solution and components in the tissue section.

Identification of Virus and Bacteria

As an example of the result of a search with specific labeled antiserum for cells infected with a virus, I refer to a portion of a microscopic preparation photographed by my former colleague, Dr. Chien Liu (*16*, fig. 1). The photograph shows 10 or so cells lining the nasal cavity of a ferret. These are typical columnar epithelial cells, with one end along the basement membrane, and the other ciliated end forming the wall of the nasal cavity. The four blue-gray cells at the top show the normal fluorescence of tissue cells in frozen section; those below show yellow-green fluorescent patches where labeled antibody has reacted with antigen in the cells. In this case, the antiserum was prepared in rabbits against the A strain of influenza virus, and aggregations of viral antigen are revealed both in the cytoplasm and the nucleus of infected cells. At the time this ferret was killed, on the third day of an experimental infection, the infection in this particular spot was demonstrable in a group of cells, but not in the contiguous ones. Moreover, there is a considerable amount of cytological detail visible; heavy amounts of antigen along outer cell walls, patches in the cytoplasm, and surprising amounts of what Liu proved to be S antigen in the nuclei. Other examples of antibody deposited over collections of antigen in infected cells are mumps virus in the acinar cells of the parotid of an infected monkey (*17*), vaccinia virus in F–J cells (*18*), and herpes simplex virus in its early stages in F–J cells (*19*).

To mention two more examples, Liu (*20*) has been able to make accurate diagnoses of influenza A in three-quarters of the cases in a small series by the examination of smears from a single nasal washing each, although the results with an outbreak of influenza B were less accurate, and Goldwasser and Kissling (*21*) have demonstrated rabies virus in Negri bodies and in brains known to contain virus in which no Negri bodies could be found. They have also found rabies antigen in the salivary glands of infected dogs, foxes, and other species. There seems little question that for some virus diseases the use of labeled antibody will become the diagnostic method of choice.

An illustrative example of the diagnosis of a bacterial disease is provided by the data of Moody and Winter (*22*) for a case of experimental *Pasteurella pestis* infection in mice, where organisms were specifically identifiable in impression smears of the spleen for a few hours after infection. Many other organisms have been investigated in a preliminary way, and it is already clear that in the cases where the serologic relationships have previously been established, specific diagnoses can be made in material containing only a few organisms. However, unexpected situations arise. For example, Thomason, Cherry, and Edwards (*23*) found among Enterobacteriaceae in the intestinal tract of man and animals many organisms having serologic relationships to *Salmonella* serotypes. Smears of feces contained many reacting organisms which were not the *Salmonella typhi* sought. Moreover, Thomason and her co-workers found that normal rabbit serum often contained nonagglutinating antibodies reactive with *Escherichia coli* and with *Proteus*, thereby producing false positive reactions when the animals were subsequently used in the preparation of a specific antiserum.

Clearly, marked antibodies are of great potential interest in the diagnosis of viral (Liu), protozoal (Goldman, *24*), and bacterial (Moody) diseases because they offer the possibility of specific identification without waiting for pure cultures or large numbers of the organisms. It is, I think, equally clear that a considerable amount of developmental work will be necessary before they are useful in the practical diagnosis of a specific infection. In the course of such developmental work it is almost certain that new information concerning the distribution of antigenic determinants and the surface structure of bacteria will be uncovered, and those who are engaged in these tasks should be alert for these dividends. Moreover, it is likely that viruses masked as completely as were the adenoviruses which we carry in our tonsils will come to light as tissue is exposed to interaction with serum from various sources. The history of immunology is largely bound up with the exploitation of such circular situations, where convalescent serum reacts with the organism

isolated earlier from the patient. (For a summary of the diagnostic uses of fluorescent antibody, see Coons, reference 25).

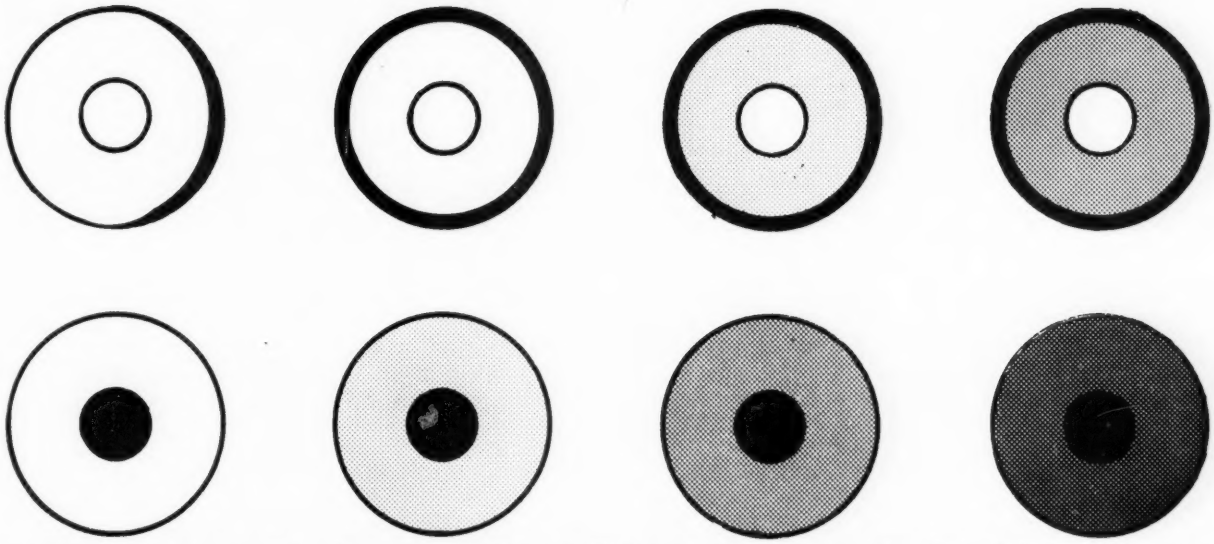
Virus-Infected Tissue

I come now to another subject because, fascinating though the problems of diagnosis are to the physician, the diagnostic bacteriologist, and the public health official, it would not be right to fill our evening with them when there are other matters of interest and concern. Also, if a speaker is unwise enough to set as his subject a method of procedure, he must be ready to follow more than one trail.

Some years ago, Dr. Barbara Watson and I (*26*) published an account of the infection of the chick embryo with the PR8 strain of influenza virus. We had examined the tissues of the embryo for viral antigen at various moments during the progression of the infection. At that time it was noticed that the first evidences of viral antigen appeared, under the conditions of the experiments, in the nuclei of the cells lining the amniotic sac into which the viral inoculum had been introduced. Later, antigenic material made its appearance throughout the infected cell. During the next year, my colleague, Dr. Liu (*16*) was able to show that the antigen demonstrable in the nuclei of epithelial cells in the infected ferret was the so-called soluble or S antigen of Hoyle (*27*). This material, which can be extracted from virus particles by ether and which contains the ribonucleoprotein of the virus has recently been found to be a rodlike structure of varying length and about 16 mμ in diameter. Antigenically, this material is known as the S (for "soluble"), or as the complement-fixing, antigen. It was shown by Hoyle to appear in infected cells before other antigenic components were detectable. The antigen is common to all strains of influenza A, which of course differ in other antigenic properties revealed by other methods of testing (hemagglutinin-inhibition). A further fact is that the S antigen of influenza A and the g or "gebundenes" antigen of fowl plague cross react powerfully, but their hemagglutinins, composed of protein and carbohydrate, do not.

Breitenfeld and Schäfer (*28*) set themselves to study the chain of events leading to the formation of completed virus particles. They employed tissue cultures of chick embryo fibroblasts infected with about 100 particles per cell of fowl plague virus. After various periods of growth, they examined the cells by means of fluorescent antibody and the yield of virus and of various antigenic components by appropriate tests. They found that the g antigen appeared in the cells before any other component was detectable, and that it was first seen 3 hours after the start of the infection. It was visible in the nucleus of the infected cells and later could also be detected in the cytoplasm. Beginning at about the fourth hour, hemagglutinin was detectable both by staining and by assay of the tissue culture cells; it was first seen in a small concentrated area near the cell nucleus, but not in it. Later, the whole cell filled with hemagglutinin, which obscures the g antigen; and filaments could be seen at the cell wall.

Watson has studied the problem of influenzal replication in the infected amniotic membrane of the chick embryo and has kindly consented to let me present a summary of her main findings. These data have not been published. Watson carried out an extensive series of experiments employing doses varying from 1,000 virus particles per cell to 1,000 cells per particle. She found that the dose has a profound effect on the appearance of viral antigens detectable inside the infected cells. When sections of the infected amnion were stained for viral antigens, it was immediately obvious that the infection was not uniformly distributed among the cells. When there was only an occasional virus particle available, antigen in the infected cells was first detectable late in the course of the infection and then usually only in and near that part of the cell membrane which faced the amniotic cavity. Only gradually, if at all, and after the appearance of infectious viral particles in the fluid, was antigenic material found deeper in the cells, and here it was usually limited to the cytoplasm. Hence, if the genetic material of the virus must enter the nucleus, as many believe, in order to initiate virus infection, the quantity is not large enough to be detectable. This condition of only an occasional virus particle per cell is of course the one found by Von Magnus to favor the production of infectious virus.



Gradual development of influenza A antigens in infected cells. Progression from left to right. Top row, infection with less than one particle per cell. Bottom row, infection with many particles per cell. (From B. K. Watson, unpublished data.)

An extreme example of the condition favoring the production of incomplete or noninfectious virus as described by Von Magnus (*29*) is that in which 1,000 particles are available per cell. In this situation Watson found that antigen, shown by absorption to be S antigen, was first visible in the nucleus and only subsequently did viral antigens spread to the cytoplasm and to a lesser extent to the cell wall. During the period when most of the cells contained antigen in the cytoplasm, noninfectious hemagglutinin appeared in the amniotic fluid.

These findings are illustrated in the diagram, which shows from left to right in the top row the usual situation when infection is initiated by small doses. The blackened areas represent viral antigen. It might be said parenthetically that only in or near the cell membrane of infected cells can identifiable virus particles be found by electron microscopy. The antigenic material deeper in the interior revealed by fluorescent antibody is evidently too close to the size of other particles normally present in the cell nucleus and the cell cytoplasm to be distinguishable. In the bottom row the reverse situation, representing infection initiated by high multiplicities of virus, is diagramed.

There is unfortunately no time to illustrate the impressive beginnings which have been made by experimental pathologists in the use of fluorescent antibody in the study of serum disease, or in the analysis of fibrin and globulin deposits in histological lesions. One curious finding has turned up in the investigation of disseminated lupus erythematosis, where the so-called L.E. factor in the serum of sufferers is found to interact with the cell nuclei of cells from many species, including fish (*30*).

Antibody Synthesis

Studies of antibody formation (*31*) have localized the site of synthesis somewhat more precisely than was possible before and have shown that the synthetic machinery is gradually established during the orderly differentiation of a specialized family of cells, plasma cells. The impression is strong that this family of cells is a specialized response to antigenic stimulation. Moreover, the marked difference in the behavior of the lymph node population during a second exposure from its relatively inapparent reaction to a first exposure is indicative of a profound change in the responsiveness of the cell population. In order to determine whether this change was progressive or whether it became stabilized, Dr. Fecsik and I (*32*) investigated the effect of prolonging the interval between the two antigenic injections on the maximum height of the secondary response in a large series of mice. We found that the responsiveness increased for 3 or 4 weeks and that thereafter it stayed at a high but fixed level for as long as half a year.

A great stimulus to investigation of the antibody response has come in the last 2 years from the introduction by Burnet (*33*), Talmage (*34*), and Lederberg (*35*) of the notion that the effect of an antigen injection is not to instruct responsive cells in the elaboration of an antibody specific to the antigen, but rather to select spontaneously appearing cells to multiply and synthesize a specific protein which by chance they are genetically capable of doing. Although some of the pictures my colleagues and I have published look like clones which might have arisen from a single cell, we have seen them spring from areas where there were at least several precursors when antibody became first distinguishable. These precursors were not at that time distributed in a clump. These observations do not rule out the possibility that such clusters are clones, nor is it necessary to postulate that antibody-forming cells spring from a single cell. There could be a number of specific mutants available. However, the appearance of these clusters must not mislead us into supposing that they must be clones.

This lecture has summarized some of the uses to which visible antibody molecules have already been put. As I predicted, the discussion has been somewhat rambling because the element uniting all these diverse findings has been a way of looking at the world rather than a unifying idea. For this reason, too, it has not been feasible to take any one of these subjects all the way to its present frontier. However, I think you will agree that immunology married to morphology has a usefulness in many areas of biology. It only remains to remember that the quality of the observations will depend on the careful analysis of the antibody solution employed as much as on the morphological knowledge which one brings to his microscope.

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Driver Health and Traffic Mishaps Studied

A pioneer project to explore the relationship between the physical and psychological status of drivers and traffic accidents was launched in May 1960 by the Connecticut Departments of Health and of Motor Vehicles and the Public Health Service. Using a mobile health examination unit, the study is scheduled to screen between 15,000 and 25,000 selected drivers during a period of 18 months to 2 years. These include chronic violators, drivers in personal injury accidents, and some whose licenses have been suspended or revoked. Selected drivers with good records serve as controls.

Examinations are made of vision and hearing, height and weight, hemoglobin, blood pressure, and the heart and chest. Also carried out are tests for anemia, diabetes, and glaucoma.

The Connecticut State Medical Society is actively participating in followup; screening test findings are evaluated by private physicians of the examinees. The findings may also be of help in shaping legislation for physical examinations of drivers.

STATEMENT

By Leroy E. Burney, Surgeon General,
Public Health Service

Influenza Immunization

Two outbreaks of influenza swept the United States in the fall of 1957 and the winter of 1958, resulting in 60,000 more deaths than would be expected under normal conditions. There were, in addition, more than 26,000 excess deaths during the first 3 months of 1960 which also were considered to be the result of influenza.

These departures from the usually predictable norms prompted the Surgeon General's Advisory Committee on Influenza Research to analyze the cause and to seek measures to prevent such an occurrence in the future.

The committee found that a new antigenic variant, the Asian strain, because of its widespread introduction and the general lack of resistance to it, was the direct cause of the excess number of deaths, not only in the total population but most markedly among the chronically ill, the aged, and pregnant women. As a result of these findings, the Public Health Service is urging a continuing program to protect these high-risk groups in order to prevent a recurrence of this excess mortality.

The high-risk groups who contribute most to the excess deaths and who the Public Health Service believes should be routinely immunized each year are:

1. Persons of all ages who suffer from chronic debilitating disease, in particular: (*a*) rheumatic heart disease, especially mitral stenosis; (*b*) other cardiovascular diseases, such as arteriosclerotic heart disease or hypertension—especially patients with evidence of frank or incipient insufficiency; (*c*) chronic bronchopulmonary disease, for example, chronic asthma, chronic bronchitis, bronchiectasis, pulmonary fibrosis, pulmonary emphysema, or pulmonary tuberculosis; (*d*) diabetes mellitus; (*e*) Addison's disease.
2. Pregnant women.
3. All persons 65 years or older.

The adult dosage recommended by the advisory committee for initial immunization is 1.0 cc. (500 cca units) of polyvalent vaccine, administered subcutaneously on two occasions separated by two or more months. Preferably, the first dose would be given no later than September 1 and the second no later than November 1. Persons previously immunized with polyvalent vaccine should be reinoculated with a single booster dose of 1.0 cc. subcutaneously each fall, prior to November 1. The only contraindication to vaccination would be a history of food allergy to eggs or chicken or a prior history of allergic reaction to an egg-produced vaccine, such as the commercial influenza product.

The time to start such a program is before the onset of the influenza season this fall. In the past, influenza vaccination has been sparse and sporadic, and primarily in response to an epidemic or the threat of an epidemic. The unpredictability of recurrence of influenza and its continued endemic occurrence are well known. Therefore, the Public Health Service strongly recommends that immunization of these high-risk groups be started now and continued annually, regardless of the predicted incidence of influenza for specific years.

The members of the Surgeon General's Advisory Committee on Influenza Research are: Colin M. MacLeod, M.D., chairman, University of Pennsylvania, Fred M. Davenport, M.D., University of Michigan, Morris Schaeffer, M.D., bureau of laboratories of the City of New York Health Department, George Burch, M.D., Tulane University, Dorland J. Davis, M.D., National Institute of Allergy and Infectious Diseases, Public Health Service, Thomas F. Sellers, M.D., Georgia State Department of Health, and Glenn S. Usher, M.D., Communicable Disease Center, Public Health Service.

Isolated cases of rabies in dogs, house cats, foxes, raccoons, and skunks were investigated for clues to the existence of an inapparent reservoir of the disease.

Sporadic Animal Rabies in Florida

JAMES E. SCATTERDAY, D.V.M., NATHAN J. SCHNEIDER, Ph.D., WILLIAM L. JENNINGS, Ph.D., and ARTHUR L. LEWIS, D.V.M.

RABIES in wildlife and domestic animals has been the subject of intensive study in Florida during the past 5 years. The State board of health laboratories examined 519 rabid animals of various species from 1951 through 1958, an average of 65 heads per year (table 1). In the preceding decade an average of 236 animals a year, mostly dogs, were found to be rabid. Vaccination and local quarantine have been credited with reducing the number of rabid animals encountered and have almost eliminated endemic rabies in dogs. With the gradual reduction of this disease in dogs and the evolution of an increasingly effective animal bite reporting procedure, the sporadic cases in wildlife have now assumed major importance in Florida.

When a careful field investigation revealed that only a single animal was infected, it was considered to be a sporadic case; that is, the rabid animal appeared to be isolated in time and space from all other rabies infections. This classification has been useful in guiding our search for evidence of possible repeated contacts with an inapparent reservoir of rabies in nature.

The quest for such a reservoir was intensified after the infection was found to be widespread in insectivorous bats in Florida (*1*, *2*). Examination of 5,503 bats (*3*) established the presence of rabies in apparently normal animals in all locations adequately studied in Florida. The evidence suggested that bats could be the inapparent rabies reservoir. Although on three occasions rabid bats were recovered from dogs and house cats which had captured them, there was no evidence that this contact spread the infection. Several attempts to infect mice in the laboratory by inducing presumably rabid bats to bite them were unsuccessful.

We undertook intensive investigations of sporadic cases of rabies to determine whether or not there existed an inapparent reservoir serving as a source for the spread of the infection in Florida.

Three hypotheses were suggested by the evidence at hand. First, there is the possibility that the bat, or some other equally elusive small mammal species, is the primary reservoir and may infect carnivores directly. In this event, the recognized vectors would be infected while capturing the reservoir species or when sniffing moribund animals that attracted their curiosity. The reservoir species would necessarily be unaggressive when rabid so as to explain its nonrecognition in the past. This theory may be called the nonaggressive, single-species reservoir.

Second, it is possible that some of our recog-

Three of the authors are with the Florida State Board of Health. Dr. Scatterday is director of the division of veterinary public health, Dr. Schneider, director of the bureau of laboratories, and Dr. Lewis, head of the virology laboratory. Dr. Jennings is a biologist with the U.S. Fish and Wildlife Service, Department of the Interior.

This investigation was supported in part by a grant from the National Institutes of Health, Public Health Service.

nized vector species support enzootic rabies which goes undetected because of irregularities in surveillance or because of the usually benign behavior of rabid individuals. Thus, the enzootic condition would be discovered at infrequent intervals, and the new, recognized infections would appear to be sporadic cases. The true nature of the spread would go undetected.

A third possibility is that several different species of wild carnivores together maintain temporary transmission chains for enzootic rabies, but the patterns of transfer within a species or between species are not clear. This may be called the multispecies endemicity hypothesis.

Other explanations, such as the arthropod reservoir and various viral change hypotheses, have been suggested, but data in support of these are not conclusive. Evidence gathered in our studies implies that these two hypotheses are not necessary to account for the behavior and continued existence of rabies infection in Florida.

We undertook intensive investigations of rabies cases which appeared to be sporadic to determine whether or not there existed an inapparent reservoir serving as a source for the spread of infection in Florida. Data in several of the early cases were incomplete or could not be verified. Victims and witnesses could not be located in several instances. We gathered detailed accounts in more than 135 cases; 36 of these were considered to be sporadic.

All rabid animals were diagnosed in the laboratories of the Florida State Board of Health. A positive diagnosis was based on identification of Negri bodies in brain material prepared with modified Sellers' stain. Animal brains in which Negri bodies were not found upon direct examination were inoculated intracerebrally into five laboratory mice which were observed for 30 days. Mice dying within this period, or those sacrificed at the end of it, were examined microscopically. All animals referred to here as rabid yielded Negri bodies at some stage of this examination.

Dogs

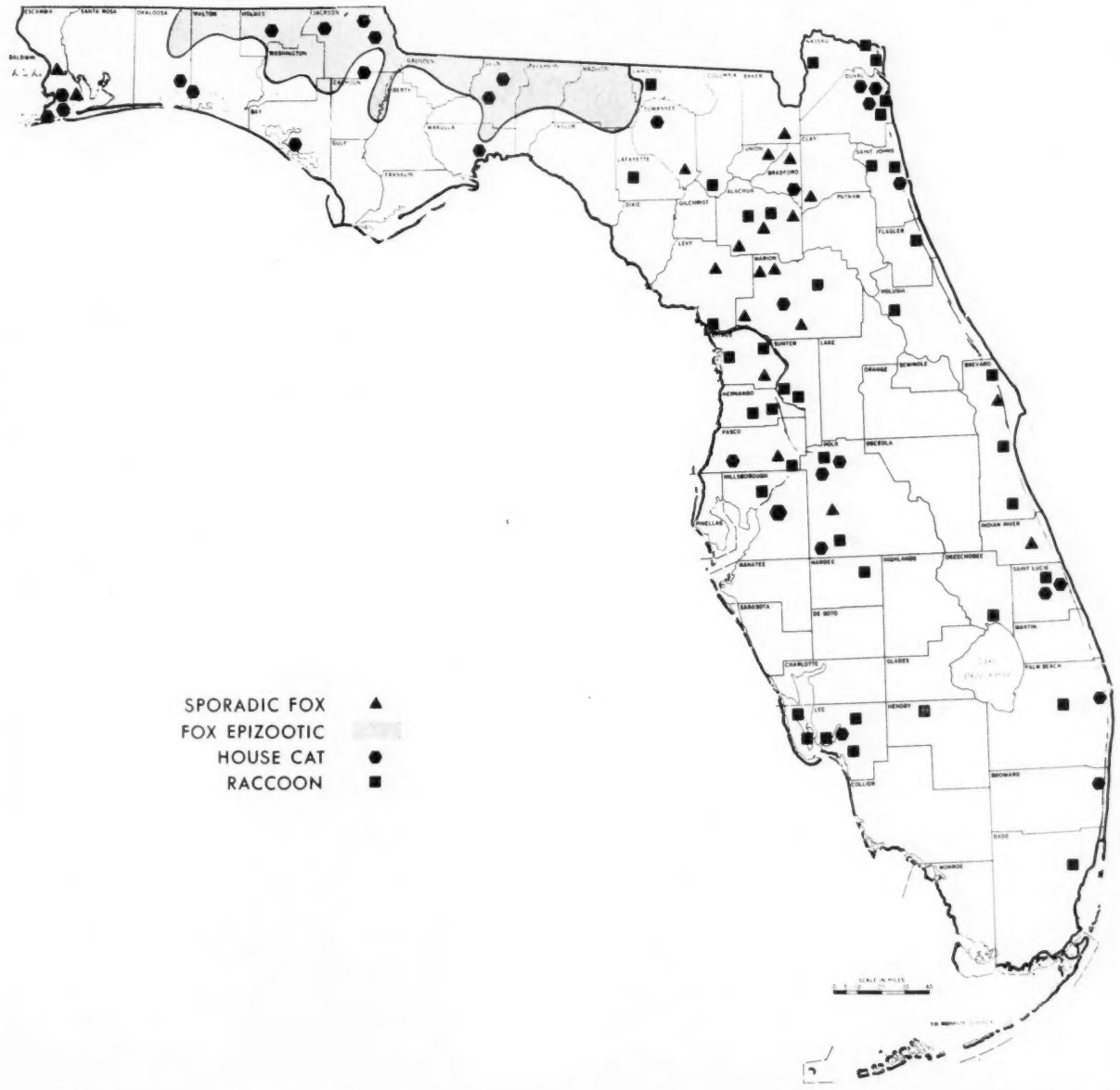
Sporadic cases of rabies in domestic dogs were investigated whenever possible, but little was learned about contacts with a possible inapparent reservoir. Of the 149 rabid dogs reported since 1951, 34 infections occurred simultaneously with a fox rabies epizootic. Most of the remainder were exposures related to urban epizootics confined to dogs. All sporadic cases, with one exception, involved stray or ownerless dogs. Rarely was the owner of a rabid dog known, and details of its origin and recent history were usually not available. This lack of data made the attempted study of sporadic cases of rabies in dogs unproductive. In the search for rabies cases caused by contact with inapparent reservoirs, little progress can be expected from studies of sporadic infection in dogs.

However, one case had an interesting history. The head of a rabid puppy about 4 months old was submitted to the State laboratory from a subdivision in Gainesville in April 1958. The puppy had been born in a nearby subdivision, and all dogs with which it had had contact, including littermates and the mother, were accounted for. After leaving the litter, the

Table 1. Rabies reported in Florida, 1951–58

Species	1951	1952	1953	1954	1955	1956	1957	1958	Total
Dog	8	12	24	23	41	10	17	14	149
Cat	0	1	2	11	5	10	9	6	44
Fox	1	0	15	19	12	14	73	16	150
Raccoon	4	7	10	16	11	13	7	15	83
Skunk	0	1	1	2	1	0	2	2	9
Bat	0	0	7	1	8	10	7	7	40
Cattle	2	0	5	16	3	4	6	2	38
Bobcat	0	0	0	0	1	0	0	0	1
Horse	1	0	0	1	1	1	1	0	5
Total	16	21	64	89	83	62	122	62	519

Figure 1. Sites [1] of rabies cases found in foxes, house cats, and raccoons, Florida, 1951–58



[1] Symbols indicate the locality. In several sites more than one individual of a species was found to be rabid. Data in some of the older records could not be confirmed and the sites are not indicated.

puppy had been housed in a utility room every night and had never had noticeable wounds. It was seen by a veterinarian several times during this period but was not immunized against rabies. No other animals became rabid during 90 days of quarantine observed by the subdivision.

It seemed unlikely that a rabid dog, skunk, fox, or raccoon could have passed through the subdivision, which was heavily populated with children and unvaccinated dogs, without attracting attention or infecting another animal. Inspection of the utility room indicated that such a vector would have had to contact the puppy outdoors in the daytime. During the previous year three rabid bats had been collected within a mile of this subdivision.

House Cats

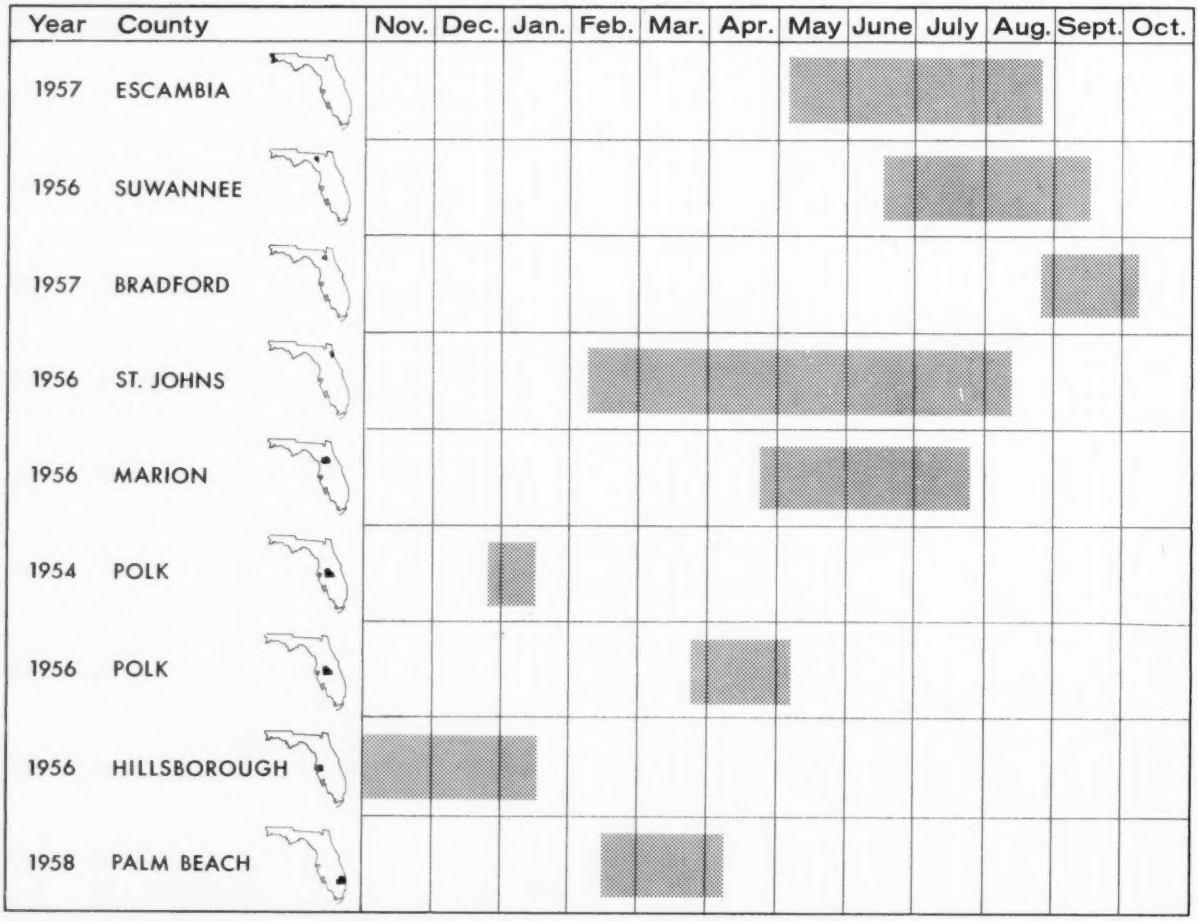
Forty-four house cats from all parts of the State were recorded as being rabid during the

1951–58 period, and persons who had been attacked by 29 of these were interviewed. Fourteen rabid house cats were reported concurrently with several fox rabies epizootics in western Florida, and at least three of these cats had been bitten severely shortly before exhibiting symptoms of rabies. Presumably, fox rabies spilled over into the house cat, since no rabid cats were observed in the years before or after fox rabies swept through these counties. All of them bit or attacked human beings, but no other cats or domestic animals. This behavior, as reported by the victims, indicated that house cats do not transmit rabies virus freely among themselves.

Twenty-one cats became rabid in peninsular Florida, where epizootic rabies has apparently been limited to infection in raccoons, which probably attack house cats. However, most of these counties have recorded sporadic rabies in other carnivores. Epidemiological investigations of rabies in house cats failed to reveal evidence of the disease in any other animal. Every rabid house cat in the peninsular counties investigated appeared to have acquired a truly sporadic infection (fig. 1).

Some of these cases may have resulted from contact with a hidden rabies reservoir. Data on rabid kittens obtained in interviews with owners were especially enlightening. Nine cases of rabies occurred in kittens less than 7 months of age. None of the mother cats or other neighborhood pets became rabid or had disappeared. Figure 2 shows the lifespans and dates of death of the kittens, arranged by counties in north-to-south order. There is some indication of a

Figure 2. Seasonal appearance of rabies during the lifespan [1] of nine kittens in Florida, 1954–58



[1] Birthdates were calculated from the best estimate of age at death, often based on the owner's memory or on size alone.

winter trend in seasonal appearance of infection toward the south.

In two cases the behavior of the vector was indicated because the kittens had been confined in screened dwellings all of their lives. One case occurred in May 1956 in the heart of Lakeland, Polk County, within a section of small, closely spaced houses. Two 6-week-old kittens were being weaned by the healthy mother cat after having lived on a screened porch since birth. The owner was reasonably sure that neither kitten had been off the porch, although a daughter may have carried them out for short periods once or twice. The rabid kitten bit the child and died a few hours later. The owner had been scratched a few days before. Evidence of rabies was found when brain tissue from the kitten was injected intracerebrally into mice and the virus was isolated by standard methods.

The littermate and three adult cats belonging to the same owner were healthy at that time. Wounds had never been observed on either kitten. The littermate died of some disease while in quarantine, but rabies virus could not be isolated from it. No other cases of rabies were reported from this area that year. Two years earlier and less than a half mile away, a rabid 3-week-old kitten, one of a litter of three or four belonging to a stray mother, bit a child. It was known that the mother cat had brought rats and mice to the kittens. Lakeland is noted for the large number of yellow bats (*Dasypterus floridanus*) collected in town (*1*). This bat has been found to have an infection rate of about 2 percent in nature and is one of the most powerful biters among Florida bats.

A similar case occurred in West Palm Beach during April 1958.. Two kittens from a litter of three died of rabies at an age of 6 or 8 weeks. These kittens were born and reared inside a screened house and left it only once, when a visiting child played with them on the lawn one morning for about an hour. The owners were certain that the kittens never left the house at any other time before they were adopted. All three went to separate homes and one developed symptoms of rabies about a week later. The other two kittens were recovered and quarantined, one dying of rabies 17 days after quarantine. The third kitten was killed and examined, but no evidence of rabies was found. The mother cat was healthy 8 months later and was described as a wonderful hunter. She had often brought in living rats and mice with which the kittens played; however, no bats were observed among the offerings.

Six other cases of rabies in kittens were investigated and found to follow this general pattern. These kittens had all spent more time outdoors, and some had never been in a house. Three of them were less than 6 weeks old. None of these kittens showed any evidence of a bite or wound. The wounds usually observed on victims of dogs, raccoons, and some foxes would kill a kitten of this size outright, and certainly could not be overlooked in the usual attention given to pets.

The data from these interviews suggest some small animal as a reservoir, perhaps one brought to kittens by mother cats and used in hunting practice. A study of the mammals used in this way is indicated. Rabies has not been reliably reported from native rats and mice in Florida, though only a few dozen of these have been examined carefully. We have observed cats use moribund and rabid bats as practice game on several occasions.

Foxes

Data on fox rabies in Florida are presented in another paper (*4*) and are summarized here. The distribution appears in figure 1. There was no clear seasonal trend in the sporadic cases. Sporadic infections were not reported from the epizootic fox rabies areas along the Georgia and Alabama borders, where two known epizootics occurred in adjacent areas of the three States.

In the peninsular counties of Florida, which are distinct from the epizootic area in geography, ecology, and economy, 18 sporadic cases of rabies have occurred in foxes since 1951. Two other rabid foxes, near Pensacola in Escambia County, were not correlated with other rabies cases and appeared to be sporadic. Since rabid foxes are reported frequently during epizootics, it is unlikely that an epizootic in the fox population would be unreported in peninsular counties such as Alachua, Marion, and Polk, where reporting is as effective as in the counties with epizootics. The fox epizootics discussed here

swept through 13 or 14 counties in one movement, requiring more than 5 years to subside. In areas with sporadic fox rabies, cases of rabies in cattle are unknown, but they are common where rabid foxes occur in numbers. Our data indicate that rabies is easily recognized when it exists in epizootic form in gray foxes. The preponderance of evidence suggests that sporadic cases are caused by an effective contact with an inapparent reservoir. However, additional data are needed on the proportion of rabid foxes which attack people as compared with those which do not.

Raccoons

Rabies was first recorded in Florida raccoons about 1947 when it appeared in Brevard County and spread north and south along the Intracoastal Waterway. By 1958, a total of 31 counties had reported rabid raccoons, most of them occurring as a sporadic case. The 83 recorded since 1951 were investigated whenever victims and witnesses could be located. Figure 1 shows the localities from which rabid raccoons were submitted to the State laboratories. The disease in raccoons is restricted to the peninsular part of the State. Even during fox epizootics, rabid raccoons were never reported from western Florida. There was no seasonal trend in the occurrence of the 47 cases on which data were available.

Estimates of the raccoon population in 11 sites where rabid raccoons had most recently been reported revealed no clear correlation between the appearance of the infection and density of the raccoon population. In five sites the local populations appeared to be at cyclic lows; in three, at nearly maximal density; and in the remaining three, the density was intermediate. These investigations revealed the short duration of extremes of abundance in raccoon populations, as evidenced by trapping success, tracks, and other signs. Movements and seasonal shifts in response to changes in water levels and seasonal food supplies influenced simple abundance estimates even more than the absolute number of animals in a unit area. It proved almost impossible to trap out a raccoon population, even when intensive efforts were made for more than a month. This is in strong contrast to fox populations, in which a reduction in tracks and in trap success is apparent after a few days of trapping (*5*).

A time and space relationship was found between rabid raccoons reported from the counties along the Withlacoochee-Hillsboro River system (midwest coastal area) and along the Intracoastal Waterway from Miami to Jacksonville. These movements showed a strong correlation between raccoon rabies and the water; 40 of the 43 animals investigated were first observed within 3 miles of a major stream or waterway. Most of them were taken along the waterways. The data indicate that spread of rabies through raccoon populations follows major waterways. The slow rate of movement and the inapparent nature of the infection make us reluctant to term this an epizootic spread, however.

The apparent sporadicity of reports seems to be caused by the unaggressive nature of rabid raccoons, according to witnesses and victims. In 38 incidents, not one person indicated that the raccoon had attacked persons or dogs unless a close approach was followed by an overt act by the victim. People were usually bitten when they or their dogs tried to kill or capture raccoons that wandered, often obviously sick and in daylight, into doorways or along streams and highways. Victims "knew" something was wrong in some cases but were vague as to how they "knew." At least five of these animals were thought to be escaped pets, and three of them were put in cages because of their gentle behavior. Two were kept as pets for several days, and their captors suspected rabies only after the animals were found dead.

Two fishermen allowed a fearless and obviously distressed raccoon to pass between them and the river in which they were fishing without being attacked. When the animal passed a second time under their cane poles, they decided to capture and submit it for laboratory examination. This uniformly benign behavior is startling when first observed by anyone familiar with the viciousness of a significant portion of rabid dogs and foxes, which attack from considerable distances.

Six of the twenty-eight raccoons taken in traps or found dead on highways in Palm Beach County by J. E. Held, D.V.M., in 1956, were

rabid. Despite this evidence of a severe localized epizootic, no attacks were reported from the area, although large numbers of people fished and picnicked along the highways and canals in this part of the Everglades. Reports of cattle and other livestock dying of rabies were rare in the raccoon rabies area, in marked contrast to the situation in parts of the State where dog or fox epizootics occurred. If raccoons are no more aggressive toward each other than they were toward the victims interviewed in this study, it is difficult to understand how the infection can be maintained in the raccoon population. Our observations on prevalence and geographic movement suggest that enzootic spread of rabies does occur in raccoons.

Unaggressive behavior did not mean that raccoons were not a serious rabies problem. On the contrary, an average of nine persons per year were bitten in Florida. Often such persons were so severely and painfully bitten they needed help to escape from the animals. Further, rabid raccoons were even more important as a vector for introducing rabies into dog populations. Dogs were especially likely to be bitten when they harassed sick raccoons that wandered into communities or towns. The dog rabies epizootic of 1955 in Tampa, Hillsborough County, probably started with a hound that had caught an infected raccoon. Nearby Pasco County had a number of rabid dogs during the same year, the disease probably spreading up the Hillsboro River through infected raccoons.

Most of the danger from the raccoon stems from the inapparent nature of rabies in these animals. This characteristic permitted the infection to move considerable distances without attracting attention. When a rabid raccoon was reported from Inverness, Citrus County, on the Withlacoochee River and its lakes, a trapping program was initiated to investigate the animal population. Of 24 raccoons captured along the river, 1 was rabid. This animal was taken about 35 miles downriver from Inverness, but the two intervening waterfront towns of Dunnellon and Yankeetown did not report any rabid animals or unusual raccoon behavior. Rabid raccoons were discovered almost simultaneously on either side of eight other river or waterfront towns, but none of the towns reported any rabid animals, although infected raccoons presumably passed through the communities.

Our data indicate that rabies was common in the raccoon population of peninsular Florida. The unaggressive nature of rabid raccoons and, consequently, the low reporting rate merit further study. Our data fail to show that raccoons have had any contact with an inapparent rabies reservoir in other species. The wide distribution but sporadic reporting of rabies in raccoons made it virtually impossible to recognize such contacts.

Skunks

Data on rabid skunks are meager in Florida. Nine cases were recorded, but there were no data on animal populations where six of these occurred. In two cases trapping yielded 30 skunks, but none of these was rabid. No rabid skunks were submitted to the State laboratories from the fox rabies epizootic area, although striped skunks, *Mephitis mephitis*, were abundant in some places. This animal inhabits all mainland Florida. The spotted skunks, *Spilogale ambarvalis* and *Spilogale putorius*, are reported only from the lower peninsula and from extreme western Florida, respectively. It is not known which species made the attacks.

Heads of two rabid animals, one fox and one raccoon, smelled so strongly of skunk scent when received in the laboratory that there was little doubt they had contacted a skunk shortly before they were killed. Obviously, rabid skunks might infect other carnivores that attack them. The infrequency of attacks by rabid skunks, the aggressive nature of one of the two rabid skunks observed, and the attention they get when active in the daytime seem to exclude the striped skunk, at least, from consideration as the effective but inapparent rabies reservoir we seek. The behavior of both genera of skunks, when rabid, should be studied under experimental conditions.

County Observations

The nature of sporadic rabies can be better understood when the cases recorded in a single county are examined. Polk County is typical

of the area where sporadic cases occurred most frequently. Twelve rabid animals were reported between 1951 and 1958, and these were distributed among six species. Careful case history studies established that no two animals of a single species were ever in contact with each other. Five animals, one bat, two kittens, one puppy, and one fox, were reported within the city limits of Lakeland, but there is reason to doubt that contact existed between any two of them. The lifespan of the kittens and the puppy did not overlap. The remaining seven rabid animals were widely separated in time and space, covering an area of more than 700 square miles and a period of 5 years. Similar situations were observed in at least 10 other counties. These 11 counties had a total of 84 sporadic cases, excluding the cases in raccoons and those related to dog rabies epizootics in two counties, or an average of almost 8 cases per county. Some cases involved bats or livestock, but an average of almost two cases per year was maintained in carnivores in each county for the years in which rabies was reported. There seemed to be a slow but steady rate of infection among the susceptible carnivores. The surveillance and animal bite reporting in these counties was probably as good as that attained anywhere.

Figure 3. Sites of sporadic rabies cases in Florida in carnivore species,[1] 1951–58

[1] Dogs and raccoons excluded. Each case for which a site is given was found to be isolated in time and geography from other known rabies cases. Sites for a few early cases could not be determined.

Comment and Conclusion

From locations of sporadic cases of rabies, excluding dogs and raccoons (fig. 3), and their seasonal incidence (table 2), it must be inferred that, if a single reservoir was responsible, it functioned constantly over a large area, but rather infrequently at any given place. There was no evidence of a slack season or of periods of increased activity in one circumscribed area.

The possibility that a multispecies enzootic exists, with infection between different species being more frequent than within any one species, has been mentioned. From data given in 197 case histories, the relationships of species of rabid animals to their victims, including persons, has been charted (table 3). A need for further study of the behavior of rabid animals of all species under experimental conditions is indicated. Some knowledge of the usual relationship between foxes and skunks, foxes and house cats, and skunks and house cats would be enlightening. The behavior of animals of all species toward rabid raccoons and bats should be investigated.

We can see from our present data, however,

Table 2. Seasonal incidence of sporadic rabies in Florida, 1951–58

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Fox	3	3	0	1	1	0	2	1	0	2	1	2	16
House cat	2	0	0	2	1	0	2	3	1	2	1	0	14
Other [1]	0	1	1	1	0	0	1	0	0	0	1	1	6
Total	5	4	1	4	2	0	5	4	1	4	3	3	36

[1] Skunk, cattle, dog.

Table 3. Species exposed by rabid animals in 197 case histories

Victim	Vector					
	Dog	Cat	Fox	Raccoon	Skunk	Bat
Dog	Yes	No	Yes	Yes	?	Yes.
Cat	Yes	No	Yes	No	No	Yes.
Fox	No	No	?	No	No	No.
Raccoon	No	No	?	?	No	No.
Skunk	No	No	?	?	No	No.
Bat	No	No	No	No	No	?.
Humans	Yes	Yes	Yes	Yes	Yes	Yes.
Livestock	Yes	No	Yes	No	?	No.

Yes = Observed contact.
No = No observed contact.
? = No observed contact but with attack indicated by epidemiological evidence.

that dogs, foxes, and possibly raccoons support epizootic rabies when suitable populations exist. Bats of various species may support epizootic rabies also, although the methods of transmission between bats, even between individuals of one species, have not been established in Florida. House cats and skunks apparently do not support epizootics, and seemingly do not infect others of their species, although skunk epizootics are reported from other States.

Dogs, when rabid, infected other dogs, house cats, and livestock, but apparently did not infect wildlife. In contrast, rabid house cats attacked only persons, and cats in contact with them did not become rabid. Foxes attacked other carnivore species, livestock, and humans. Observations indicated that some rabid foxes will attack anything moving, including inanimate objects. In contrast, rabid raccoons attacked nothing that did not first attack or threaten them.

Bats have exposed persons, dogs, cats, and presumably wildlife species also. There is now evidence that rabid bats are infective (*6*). Any reservoir likely to infect cats, kittens, or puppies may be considered equally likely to function for skunks, foxes, and even raccoons.

If these data adequately depict the status of rabies in Florida, some general impressions can be expressed concerning the existence of an inapparent reservoir. The epizootics observed in foxes and the endemism seen in raccoons may explain all of the rabies cases recorded from western Florida and some of the sporadic cases in the peninsula. Since some of the sporadic cases, especially in kittens, could not possibly be traced to a bite by a raccoon, fox, or dog, it is logical to assume that some other vector is responsible, at least for some of these cases. It may be that this vector, which functions for kittens, and presumably for cats, infects other species also. Whether rabid insectivorous bats are capable of this, we do not know, though our data seems to exclude the carnivores. There is little room for doubt that some wildlife reservoir for rabies exists in Florida. Its identity and the means of the spread of infection need to be determined by further study.

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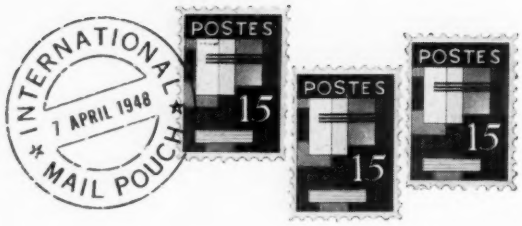


Wells for Siem Reap

After 8 wells were drilled in a demonstration, the residents of Siem Reap, a town of 10,000 population, drilled an estimated 300 additional wells themselves. Cambodia's Ministry of Public Health and the U.S. Operations Mission supplied pumps, casing, and drilling equipment.

—ANTHONY J. KRANASKAS, *acting chief, Public Health Division, U.S. Operations Mission, Cambodia.*

Quackery in the U.S.S.R.

For publishing and promoting quack cures for cancer and other diseases, the Soviet press was assailed by a panel of 16 prominent Soviet physicians, headed by Prof. Nikolai N. Blokhin, president of the Academy of Medical Sciences, it was reported by the *New York Herald Tribune*, April 22, 1960. The physicians charged that the press was confusing the public and discrediting Soviet medicine in publishing reports of "cures" which had been proved to be spurious and dangerous.

The articles the physicians cited described a professor's claim that cancer was caused by round worms, a "cured" case of stomach cancer in a patient who later had to have his stomach removed because of the malignancy, a remedy of boiled vodka and nonrefined resin for tuberculosis, and a special machine that "cured" a ballet dancer's rheumatic affliction.

Self-Help in Thailand

In the Korat Province of Thailand, village health committees are sponsoring the development of health services in 20 village areas, each comprising one or more villages. A total of 14 wells have been installed, protected, equipped with pumps, and 1,344 sanitary privies completed.

For example, in Natavong an eight-member health committee has been functioning energetically for 5 months. The headman donated, for the use of the health worker, a demonstration house which was quickly improved and became a model for the 74 families of the village. Under the committee's leadership, the villagers dug, cased, and covered one well, dug a second, and are planning two more. All but 16 families have privies and many of the men constructed their own privy slabs at the demonstration house. The village is clean and road work is underway. A midwife has established herself and is working effectively. The people of neighboring villages, interested in the achievements in Natavong, asked for a meeting, and a single health committee to serve a nine-village area is planned.

The villagers of Talang in the island Province of Bhuket wanted a clean marketplace and safe water. Although they numbered fewer than 1,000, they organized, and in a few weeks planned and built a market with concrete stalls and good drainage and developed a safe deep well with sufficient flow of water to clean the market daily and serve two schools and public outlets on the main street. Funds, raised locally, paid for a pump, a 4,000-liter elevated storage tank, and the construction of the market.

—ANDREW P. HAYNAL, M.D., *chief, public health division, U.S. Operations Mission, Thailand.*

The Korat Pump

Thai and United States members of the village health and sanitation project have devised a low-cost hand pump to meet special needs in supplying water to the villages.

Required was a pump that could be manufactured of materials locally available throughout the country, and capable of being maintained without removing the pipe from the well, so that block, tackle, and tripod would not be needed.

The Korat pump consists almost entirely of ordinary 2-inch water pipe, including the cylinder. A machine shop can produce it at a total cost equivalent to $20. Thirty of the Korat pumps were built and installed in various areas and are being evaluated under varying conditions. A form was developed to record data on operations. If the findings are favorable, large-scale production of the pumps will be started to supply an increasing demand in the villages.

—ANDREW P. HAYNAL, M.D., *chief, public health division, U.S. Operations Mission, Thailand.*

Coccidioidin testing of home-raised cattle in Arizona defined geographic boundaries and indicated the relative infectivity of various parts of the endemic area of the State more specifically than skin tests of human beings. The endemic area was found to be practically co-terminous with the Lower Sonoran Life Zone.

Distribution of Coccidioides immitis Determined by Testing Cattle

KEITH T. MADDY, D.V.M., M.P.H., H. GILBERT CRECELIUS, Ph.D., and RICHARD G. CORNELL, Ph.D.

GEOGRAPHIC distribution of *Coccidioides immitis* in Arizona has been estimated previously by noting the areas of the State in which cases of coccidioidomycosis in human beings are reported (*1–10*), by several skin test surveys (fig. 1) conducted on various population groups (*10–17*), and by trapping rodents in specific geographic areas and examining them for the presence of *C. immitis* (*18*).

Skin test studies on man, however, have all had shortcomings which make pinpointing the infectivity of a small area difficult. In some instances large areas with little population were not surveyed. Many persons who migrate to Arizona from the midwest have been previously infected with *Histoplasma capsulatum*, a potential cause of a cross reaction to the coccidioidin skin test. Also, persons living in the State travel about a great deal both inside and outside Arizona.

Although only a few studies of coccidioidin skin tests in animals have been reported (*19*, *20*), it has been shown that cattle within the more obviously endemic areas become infected and react to skin tests. This study was undertaken to determine more definitely the extent of the endemic areas and to map the relative infectivity in various parts of Arizona.

Materials and Methods

Between 1954 and 1959, 11,643 cattle were coccidioidin skin tested in the 14 counties of Arizona. The cattle were selected at random in various parts of each county. Few of these animals had been more than several thousand feet from where they were born. Their ages to the nearest year ranged from 1 through 6.

Lot 15087 of coccidioidin was used early in the survey and later lot 59–62 was used. It was standardized to the same sensitivity as lot 15087 by simultaneously testing cattle with both skin test agents and then concentrating the 59–62 behind a collodion filter until the skin test agents gave identical results. Both lots were furnished by Dr. C. E. Smith of the University of California at Berkeley.

The specificity of undiluted lot 59–62 in de-

Dr. Maddy, a veterinarian with the Communicable Disease Center, Public Health Service, is stationed at the University of California School of Public Health, Berkeley. Dr. Crecelius is director of the division of laboratories, Arizona State Department of Health. Dr. Cornell is chief of the Laboratory and Field Station Statistics Unit, CDC, in Atlanta, Ga.

The article is based on a paper given at a conference of the Epidemic Intelligence Service, CDC, in Atlanta, Ga., on April 16, 1959. The investigation was supported in part by a grant from the National Institutes of Health, Public Health Service.

tecting cattle experimentally infected with *C. immitis* has been reported (*21*). Several other preliminary experiments were carried out on naturally infected cattle in the endemic area to arrive at a standard testing procedure. They are summarized briefly here.

Each of 181 cattle was injected intradermally with undiluted and with 1:2, 1:5, 1:10, and 1:100 dilutions of coccidioidin. All animals that reacted positively (indurations of more than 5 mm.) to diluted skin test agents also reacted to the same agent when it was used in a more concentrated form. The reverse was often not the case; that is, an animal might react to a concentrated agent but fail to react to a more dilute solution of it. To the undiluted, 135 reacted, 121 reacted to the 1:2, 94 to the 1:5, 78 to the 1:10, and 37 to the 1:100.

Undiluted coccidioidin was injected in the cervical area of 861 cattle. These skin tests were checked at the following intervals with the following numbers of positive reactions: 24 hours, 310; 48 hours, 380; 72 hours, 455; 96 hours, 505; 120 hours, 435; and 144 hours, 263. Of these cattle, 243 were injected simultaneously in the caudal fold area. The cervical area test resulted in 146 positive at 96 hours, and 87 of these same animals had reactions in the caudal fold area. None of the 59 cervical area negative cattle gave independently positive reactions in the caudal fold area. There were fewer positives both before and after the 96-hour reading.

Simultaneously, 264 cattle were injected intradermally in the cervical area with 0.1 ml. doses of undiluted coccidioidin and a control broth handled the same way coccidioidin is in its preparation. The control broth gave negative results in all animals, and the coccidioidin gave indurations of more than 5 mm. in 131 animals at 96 hours.

From these preliminary studies it was decided that the coccidioidin would be injected undiluted intradermally in the cervical area

Table 1. Results of coccidioidin tests of home-raised Arizona cattle, by counties

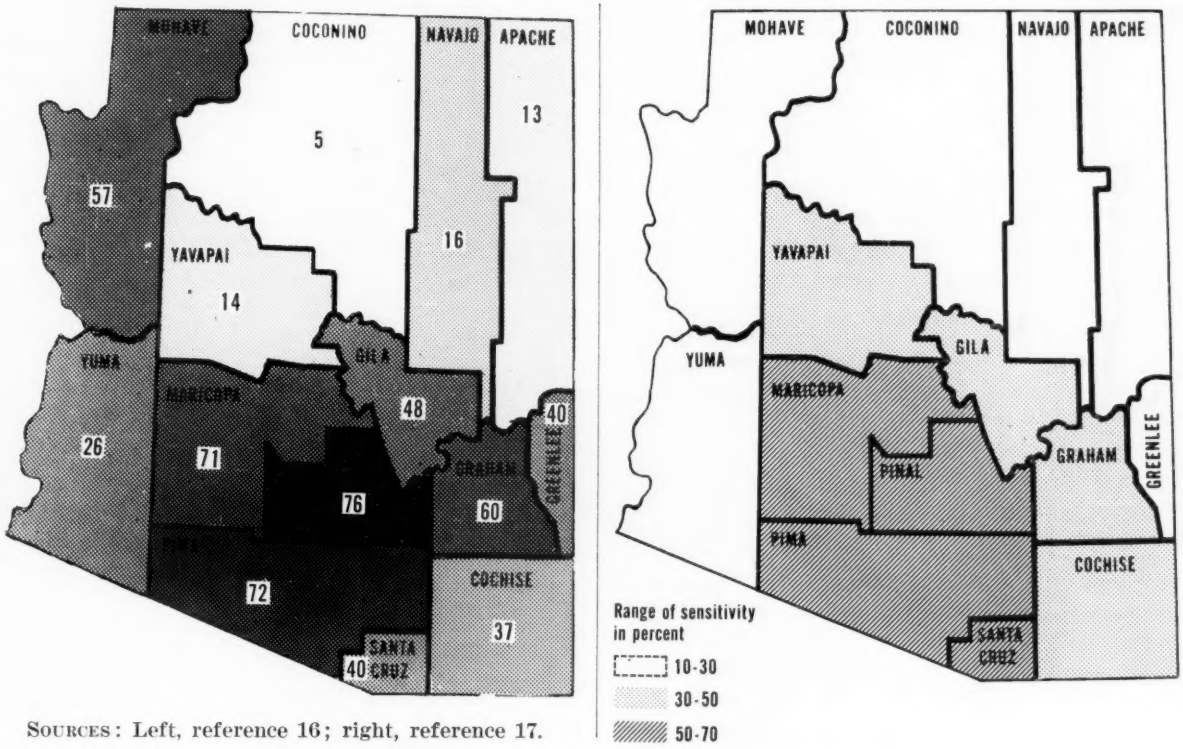
County	Total		Age to nearest year												IAC rates [1]	AC rates [2]
			1		2		3		4		5		6			
	T	P	T	P	T	P	T	P	T	P	T	P	T	P		
Apache	702	0	78	0	320	0	146	0	40	0	68	0	50	0	0	0
Cochise	636	121	15	1	80	16	235	41	115	17	108	25	83	21	.05	.05
Coconino	516	0	68	0	390	0	21	0	16	0	14	0	7	0	0	0
Gila:																
Low altitude	593	377	291	127	238	209	27	14	16	12	13	10	8	5	.28	.25
High altitude	706	1	131	0	374	1	93	0	61	0	32	0	15	0	0	0
Graham	712	260	106	11	159	34	91	28	146	65	118	54	92	68	.17	.15
Greenlee	544	129	107	14	217	51	112	21	45	18	43	11	20	14	.13	.13
Maricopa	1,446	761	367	89	389	179	197	137	213	134	151	113	129	109	.30	.26
Mohave:																
Low altitude	908	120	209	10	354	32	209	36	51	8	53	11	32	23	.11	.11
High altitude	530	7	53	0	142	1	71	2	25	0	78	1	161	3	.003	.01
Navajo	722	10	304	2	203	5	61	1	52	1	61	0	41	1	.003	.01
Pima	623	351	243	71	97	69	87	70	91	64	89	68	16	9	.27	.24
Pinal	579	438	182	97	147	130	106	91	53	44	48	41	43	35	.41	.34
Santa Cruz	629	117	211	24	231	42	123	27	46	15	7	4	11	5	.12	.11
Yavapai:																
Low altitude	585	76	251	18	110	13	139	16	30	4	23	6	32	19	.09	.09
High altitude	635	5	253	1	186	2	131	1	12	0	18	0	35	1	.003	.01
Yuma	577	86	163	11	149	21	192	31	36	9	30	12	7	2	.07	.07
Total	11,643	2,859	3,032	476	3,786	805	2,041	516	1,048	391	954	356	782	315	0.10	0.09

T = Number tested. P = Number positive.

[1] Instantaneous annual conversion rates. [2] Annual conversion rates.

NOTE: See technical note p. 961 for method of calculating annual conversion rates.

Figure 1. Percent of sensitivity of white persons 17–21 years of age who were lifetime one-county residents (*left*); percent of sensitivity of 955 students 13–24 years of age who had spent 80 percent of their lives in the State (*right*).



SOURCES: Left, reference 16; right, reference 17.

Table 2. Results of coccidioidin tests of home-raised Arizona cattle, by home altitudes

Altitude (feet)	Total		Age to nearest year												IAC rates[1]	AC rates[2]
			1		2		3		4		5		6			
	T	P	T	P	T	P	T	P	T	P	T	P	T	P		
0–500	577	86	163	11	149	21	192	31	36	9	30	12	7	2	0. 07	0. 07
500–1,000	770	147	79	0	321	35	177	38	83	20	72	30	38	24	. 12	. 11
1,000–1,500	1, 447	851	420	126	389	211	202	161	191	138	135	110	110	105	. 29	. 25
1,500–2,000	414	271	129	60	119	87	70	56	30	24	31	22	35	22	. 42	. 34
2,000–2,500	1, 216	728	534	198	335	278	114	84	107	76	102	78	24	14	. 28	. 24
2,500–3,000	668	246	104	9	142	33	88	28	133	59	114	52	87	65	. 17	. 15
3,000–3,500	887	126	381	28	171	21	202	25	43	8	37	9	53	35	. 10	. 10
3,500–4,000	1, 173	246	318	38	448	93	235	48	91	33	50	15	31	19	. 12	. 11
4,000–4,500	746	136	55	3	125	18	238	41	128	23	112	27	88	24	. 06	. 05
4,500–5,000	1, 099	11	268	1	300	2	202	3	37	0	96	1	196	4	. 003	. 01
5,000–5,500	337	10	142	2	99	5	29	1	21	1	19	0	27	1	. 01	. 01
5,500–6,000	373	0	162	0	103	0	31	0	28	0	37	0	12	0	0	0
Above 6,000	1, 936	1	277	0	1, 085	1	261	0	120	0	119	0	74	0	0	0
Total	11, 643	2, 859	3, 032	476	3, 786	805	2, 041	516	1, 048	391	954	356	782	315	0. 10	0. 09

T = Number tested. P = Number positive.
[1] Instantaneous annual conversion rates. [2] Annual conversion rates.

NOTE: See technical note p. 961 for method of calculating annual conversion rates.

and that indurations of more than 5 mm. in diameter at 96 hours would be considered positive.

The skin test agents were injected in many cattle at the same time that their blood was being collected for brucellosis serology. In each county some of the same cattle were also tested with other skin test agents, 841 with histoplasmin and 763 with haplomycin.

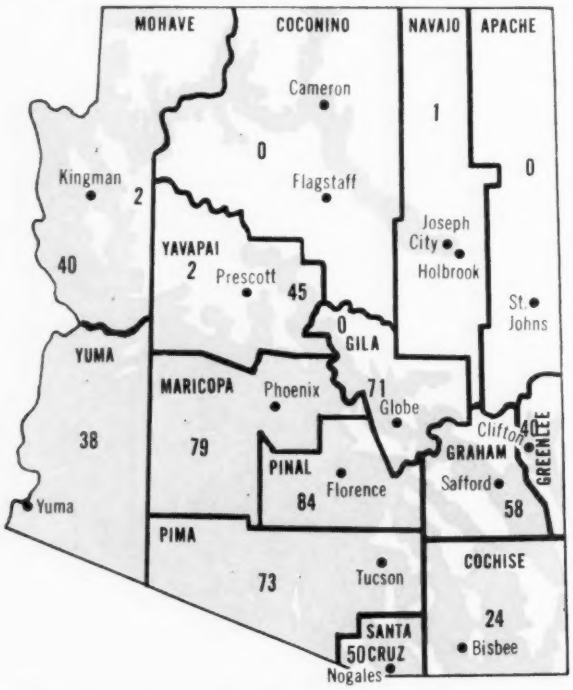
Histoplasmin lot D–2770 was also used in testing 841 of the coccidioidin-tested animals. Haplomycin lot "Phillips 4, antigen 16" was used in testing 763 of them. These two skin test agents, supplied by Dr. M. L. Furcolow and Dr. R. W. Menges of the Communicable Disease Center, Public Health Service, were injected and read by the same method used for coccidioidin.

Results

The results of the coccidioidin tests are summarized in tables 1 and 2 and figures 2 and 3. The conversion rates to a positive reaction for each geographic area were computed by a method outlined by Manos (*22*). From various areas of each county of Arizona 11,643 home-raised cattle 1–6 years of age were coccidioidin tested and 2,859, or 24.6 percent, were found to be positive.

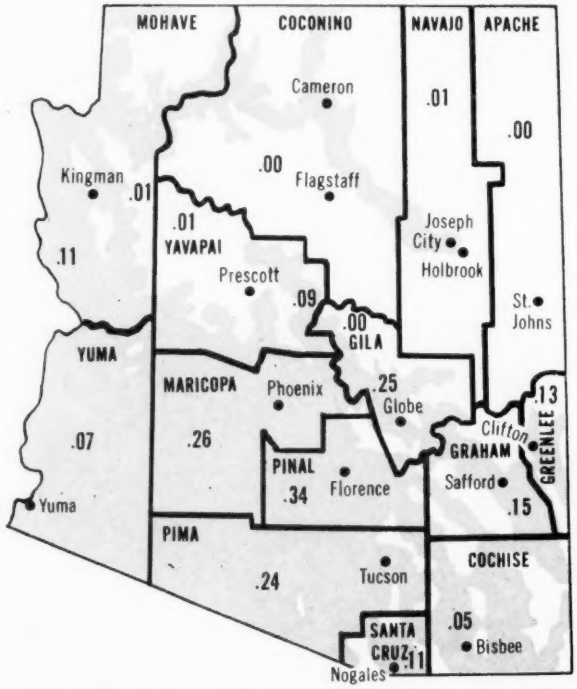
High annual conversion rates (0.24 and

Figure 2. Percent of coccidioidin sensitivity by counties in tests of 1,736 cattle 5 and 6 years of age [1] in Arizona



[1] The prevalence of coccidioidin sensitivity in persons who do not move about a great deal is comparable to the prevalence of coccidioidin sensitivity in cattle in the same area. Persons who have lived in an area for 12 years or more have about the same rates as 5- and 6-year-old cattle.

Figure 3. Annual conversion rates [1] to a positive coccidioidin test among 11,643 cattle in Arizona



[1] The annual conversion rates, calculated by the Manos method, are almost the same as the actual human infection rates.

NOTE: Only cattle that spent their entire lives on the ranch where they were born were tested. Two percentages are given for Mohave, Yavapai, and Gila Counties; one for tests within the Lower Sonoran Life Zone, the other for tests above the zone. All tests in Greenlee County were within the zone; all tests in Coconino County were above the zone.

above) were found in cattle in the three counties (Pinal, Maricopa, Pima) known to have high human conversion rates. The cattle in the low altitude areas of Gila County were also found to have high annual conversion rates, particularly the areas around the artificial lakes on the Salt River.

Medium annual conversion rates (0.11–0.15) were found in cattle in the low altitude areas of Mohave County as well as in Graham, Greenlee, and Santa Cruz Counties.

Low annual conversion rates (0.05–0.09) were found in cattle in Cochise and Yuma Counties, and the low altitude areas of Yavapai County.

Navajo County and high altitude areas of Yavapai and Mohave Counties had a few coccidioidin reactors, resulting in an annual conversion rate of 0.01 for each of the three counties.

No coccidioidin-positive cattle were found in the high altitude areas of Gila County or in Coconino or Apache Counties.

The areas of the State in the altitude range of 1,000 to 2,500 feet had high annual conversion rates (0.24 and above). The rates were lower at less than 1,000 feet altitude and became progressively lower with increases in altitudes above 2,500 feet, so that at 4,500 feet the rate became negligible (0.01), and at 5,500 feet and above it was 0.00.

Although several herds of cattle at altitudes above 4,500 feet had been fed sizable quantities of feed raised in the parts of the State where cattle had high annual conversion rates, only a few animals in these herds were coccidioidin positive.

Of the 841 cattle tested with histoplasmin, 11 gave positive reactions, but all were also coccidioidin positive. There were 18 cattle positive to haplomycin of 763 tested; these same 18 were also coccidioidin positive. The histoplasmin- and haplomycin-positive reactions were found in cattle in areas of high endemicity for coccidioidomycosis.

Discussion

The skin test surveys on humans in Arizona that are summarized in figure 1 indicate that the number of infections is greater in south

Figure 4. The Lower Sonoran Life Zone of the United States. The endemic area of coccidioidomycosis is almost identical to the zone.

central Arizona than in the northeast part of the State. Figures 2 and 3 showing the cattle test data indicate much sharper differences of infectivity of the various areas of the State. The similarity of the endemic area for coccidioidomycosis with the Lower Sonoran Life Zone, a climate zone (fig. 4), has already been discussed (*23*, *24*).

The Lower Sonoran Life Zone of the Northern Hemisphere has high January and July temperatures and rainfall ranging up to 20 inches per year. The evaluation of three items of climate in combination, the average January temperature, the average July temperature, and the average annual rainfall, yields a good basis for estimating the prevalence of coccidioidomycosis. The July mean temperature of areas of high infectivity is above 80° F. Some infection occurs in areas with July mean temperatures as low as 77° F., but not often below this. The January mean temperature is above 45° F. in areas of high infectivity. Some infections occur where the January mean temperature is as low as 35° F., but not often below this. The annual rainfall is about 5 to 20 inches in the more obviously endemic areas. As rainfall gets progressively less than 5 inches, infectivity of the area drops. Infections do not occur in areas with more than 20 inches unless there are particularly high temperatures to reduce precipitation effectiveness.

The Lower Sonoran Life Zone in Arizona

reaches its coldest limits at just above 5,000 feet altitude in most parts of the State. However, the upper limits of the zone are affected somewhat by the latitude and the general slope of the land. Table 2 reveals the gradual drop in conversion rates as the altitude increases above 2,000 feet. The areas of the State that are below 1,000 feet have high January and July temperatures, but also have low rainfall, usually averaging less than 5 inches per year. These areas appear to be too dry for good propagation of this fungus.

Land below 5,000 feet altitude along the Little Colorado River between Cameron and Joseph City is indicated as Lower Sonoran in figures 2 and 3. This was classified at one time as Lower Sonoran (*25*) but later was dropped (*26*). Since the only positive animals found in Navajo County were 10 animals at Joseph City, fed locally raised feed, we thought it best to indicate the difference of opinion on the extent of the zone in this area (fig. 4). No tests were made on cattle in the Grand or Little Colorado Canyons; consequently, there were no positives found to affect Coconino County data.

Comparison of the data for cattle with those for persons reveals that cattle become infected at about twice the rate for persons living in the same area. A previous Arizona study revealed the tendency for the prevalence of positive skin test reactions of persons to level off after 12 years of exposure (*17*). In cattle it was found that after 6 years of exposure there was also a marked leveling off. Because of this, all animals beyond 6 years of age were eliminated from this study. This leveling off is no doubt related to the reversions of positives to negatives. The annual conversion rates from negative to positive in a previous study (*17*) on human beings, as calculated by the Manos method, was a little less than half that found for the cattle in this study when the rates were calculated by the same method.

The annual rate of conversions to positives among cattle (table 1) is almost identical to that found in skin tests of persons in Maricopa, Pima, and Pinal Counties (*10*, *12*, *13*) during the first year of exposure. Therefore, the rates for cattle (fig. 3) are indicative of the actual percent of a susceptible human population that becomes infected per year for each county.

Other studies by Maddy on cattle in these same counties in which cattle were coccidioidin tested every few months revealed that the conversion rates to positive were about double those indicated by the annual conversion rates for cattle in this study, using the Manos method. No doubt this also reflects the loss of positives among infected cattle over a period of a few years.

Comparison of data for persons and cattle also indicates that the prevalence of coccidioidin sensitivity of cattle 5 and 6 years of age (fig. 2) is about the same as that found when persons with 12 years or more of exposure in the endemic area are tested.

This study revealed for the first time that the low altitude areas of Yavapai and Mohave Counties and additional areas of Gila County are endemic for coccidioidomycosis. The absence of test results positive only to histoplasmin and haplomycin indicated that all reactions to these two test agents were cross reactions caused by *C. immitis* infections in cattle. Therefore, it is believed that the cattle tested in this study were not infected with *H. capsulatum* or *Haplosporangium parvum.*

In this study fomites, such as feeds raised in endemic areas, did not appear to be good vehicles for transmission of *C. immitis* to cattle in nonendemic areas fed these feeds.

We believe this study has served as an example of how an animal with a limited home range, that also acquires an infection common to man, can be used to delineate the geographic distribution of the infective agent. For instance, if a good blastomycin could be produced, perhaps a skin test survey of home-raised cattle in selected areas of central and eastern United States would also reveal useful ecologic data on blastomycosis.

Summary

From various areas of each county of Arizona, 11,643 home-raised cattle 1–6 years of age were coccidioidin tested and 2,859, or 24.6 percent, were found to be positive. Whereas previous human skin test surveys have given only indefinite indications of the extent of the endemic areas, this study revealed rather definite boundaries and the relative infectivity of

various parts of the endemic area of the State. The endemic areas were found to be practically co-terminous with the Lower Sonoran Life Zone.

The low altitude areas of Yavapai and Mohave Counties and additional areas of Gila County were established as endemic areas for the first time, and several areas of the State of above 5,500 feet altitude, previously in a suspect classification, were found to be noninfective to cattle.

The annual conversion rates for cattle, calculated by the Manos method, were found to be almost identical with the actual human infection rate per year in those counties where this relationship was studied.

TECHNICAL NOTE

To calculate the instantaneous annual conversion rates and the annual conversion rates of cattle in this study, the Manos method was used. The plotting of the complements of the sensitivity prevalence rates, p, against age, t, on semilogarithm paper in reverse is equivalent to plotting π against t on ordinary graph paper, where $\pi = \log_e \frac{1}{1-p}$. The slope r of such a graph at any point is equal to $\frac{d\pi}{dt}$ which is equal to $\frac{\frac{dp}{dt}}{1-p}$, that is, the instantaneous rate of change in prevalence divided by the proportion of negative reactors at that age. If there is no reversion, the slope r is therefore equal to the instantaneous conversion rate. This is true only in an abstract sense, however, if the conversion rate varies with time.

If t is expressed in years, then r is the instantaneous annual conversion rate. It can also be thought of as the annual attack rate, where the attacks that occur on the nonreactors result in conversions, but where some of the attacks occur on animals already positive. The proportion of conversions that would actually be observable in a 1-year period would be equal to $1-e^{-r}$. This quantity is always less than r, but the difference is small except in highly endemic areas. It is this quantity that is commonly called the annual conversion rate in the literature.

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Deaths from Electric Current

Accidental deaths caused by electric current numbered 1,030 in 1957. Of these, an estimated 650, or 63 percent, resulted from injuries sustained while at work. The category of work injuries with the largest number of deaths, estimated at 150, was that involving contact between the booms of cranes or similar machines and high-tension wires. Decedents in these accidents included helpers and other workers who were holding guy wires or were otherwise in contact with the machines, as well as operators.

The item on the death certificate asking for the decedent's usual occupation yields minimal data because of the frequent use of general terms such as "maintenance worker" or "laborer." About 120 of the decedents, however, were listed as linemen, with another 120 reported as electricians. While persons in these occupations have a higher than average exposure to lethal voltages, they probably have a greater than average awareness of the hazards and have received more comprehensive safety training concerning electricity than most other workers. Nonetheless, the fatalities represented by these occupations contributed roughly 37 percent of work injury deaths from this cause.

The following tabulation, which classifies deaths according to the manner of injury and whether or not injury took place at work, is based on a 10 percent sample of deaths assigned to accidents caused by electric current (category E914, International Lists). Data include only deaths occurring within the continental United States.

Manner of injury	*Number of deaths*
Work injury:	
Contact of cranes or similar machines with high-voltage lines	150
Other work contact with high-voltage lines	290
Other specified work injuries	120
Unspecified work injuries	90
Nonwork injury:	
Electrical tools and equipment, not at work	80
Accidents involving household appliances	50
Accidental contact at play	90
Other specified nonwork injuries	80
Unspecified accidents, not stated as work injuries [1]	80
Total	1,030

[1] Including 20 deaths specified as from nonwork injuries.

—Warren W. Morse, *analytical statistician, National Office of Vital Statistics, Public Health Service.*

The Philadelphia Plan for Decentralization of Environmental Health Activities

P. W. PURDOM, P.E., M.S.E., M.G.A.

EARLY IN 1958, the Philadelphia Department of Public Health decentralized its environmental health activities, which are performed by personnel operating in 10 health districts, each with about 200,000 residents. Initially, the decentralization move affected environmental health activities related to food and the general environment, and later, industrial hygiene. Radiation, air pollution control, and veterinary public health activities have been retained as central activities because of lack of sufficient trained personnel to staff each district office. Accident prevention has not been decentralized because it is in the early stages of development.

Among the unique features of the decentralization was the special emphasis on democratic processes in the planning stages and on close, informal collaboration between district and central units. Also, a special unit was set up solely for the purpose of resolving questions produced by drastic changes in administration.

The background of this decentralization begins with the proposal for such action several years earlier. At that time, however, sanitation regulations of the Philadelphia Department of Public Health were being extensively revised.

Work practices were undergoing marked changes. A number of new persons were being recruited, and older employees were being reassigned. New activities were being added to our work program. Under these conditions uniformity in the interpretation of standards and utilization of common procedures were of paramount interest. We were particularly concerned about the degree of emphasis and enforcement practices in use throughout the city. A measure of similarity in the various districts was imperative. These factors, together with the initiation of new programs, seemed to require strong central direction. At that time all sanitation field personnel, while based in district offices, were under a district supervisor directly responsible to the central environmental health division.

As our programs developed, however, the necessity for these stringent measures decreased. Field personnel became familiar with the standards, and interpretations became more uniform. As the new sanitation district supervisors matured in their jobs, they were naturally given more responsibility for planning and directing the work under their supervision.

Gradually with progress, we found that there were disadvantages to a strong central approach in an area such as ours. As new operations became effective, the central office was swamped with detailed administrative problems coming in from the districts. This took the valuable time of highly trained and experienced individuals in the central office who should have been devoting the greater portion of their effort to planning, evaluating, and directing the programs of environmental health. No time could be given to analysis of what we were doing to improve efficiency.

In addition, community relations of the en-

Mr. Purdom is director of the division of environmental health, Philadelphia Department of Public Health. *The paper was given in substantially the same form at the meeting of the American Public Health Association at Atlantic City, N.J., in October 1959.*

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vironmental health programs suffered because we had isolated this activity from the others of the health center. The community generally looked to the district health director to give advice and guidance in the solution of health problems of the district. Since the environmental health programs were under strong central control, the district health director knew very little of what was going on in his area to which he could lend assistance.

The Decentralization Process

The mechanics whereby the Philadelphia Department of Public Health evolved its plan for administrative decentralization began with the appointment of the Committee on Organization of Local Services. Popularly called the COOLS Committee, it was composed of a district health director, the director of the nursing division, the director of the division of epidemiology, and the administrative assistant to the director of public health services. The director of environmental health was chairman. Through the discussions of this committee the opposing points of view of districts seeking autonomy and central divisions seeking direct control were submerged in the interest of developing the best workable plan for the administration of programs. The director of public health services later adopted almost the complete report of this committee in the plan for administrative decentralization of operations.

What were some of the features of this plan for decentralization? Principally, there was a theory of working together through which an understanding was achieved and a compromise plan developed that was neither district autonomy nor direct central control. The committee also recognized the necessity for program planning and the development of standards on a citywide basis.

For these purposes it was considered that there were major functional groupings: professional direction and operations. Another group of activities might be considered management services, but they are not particularly pertinent to this question of decentralization.

In the plan adopted, the professional direction group was charged with primary responsibility for determining program content and professional methods and for broad supportive professional action. This includes program planning and development, establishment of technical procedures and program standards, evaluation of program performance and effectiveness, consultation service to district directors and their staffs, and the establishment of enforcement control. Members of the professional direction group, representing the central staff of the various divisions, are responsible in their respective areas for such agencywide matters as the establishment of position classes, performance standards, recruitment and appointment, resolution of competitive budget and staff needs, personnel rotation schedules, professional and technical training, and consultation on performance evaluation and discipline of professional district personnel. Also included are relations with other agencies whose area of concern extends beyond district limits, as well as specifications for the content of technical records and materials to be used.

Operational activities under this plan were

Decentralization in Perspective

"APOLLODORUS: There are many difficulties, Socrates. In the first place it would offend against one of the two fundamental principles of democratic administration—the one that says that the superior authority should never interfere with the right of the inferior authority to do the wrong thing.

"SOCRATES: What is that principle called?

"APOLLODORUS: It is the principle of decentralization.

"SOCRATES: You spoke of two fundamental principles, Apollodorus; what is the other?

"APOLLODORUS: It is the principle of centralization, or decisions at the national level.

"SOCRATES: When is that used?

"APOLLODORUS: When the superior authority wishes to prevent the inferior from doing the right thing.

"SOCRATES: Well, tell me what the other obstacles are.

"APOLLODORUS: In the first place so many groups of people would benefit from the plan that it is very unlikely to come about."

—*Lancet*, January 24, 1959.

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to be decentralized where this was feasible through the various district offices in the city. Responsibility for district health operations was decentralized in these instances to bring the service as close as possible to those using it.

Primary responsibility and authority for the execution of field activities were assigned to the district health directors. The districts were made responsible for efficient and coordinated local execution of operations in accordance with established professional techniques and program standards. District operations encompass the initiation of district requests for capital and operating budgets and for personnel and material; accountability for district expenditures, work assignment, and supervision of personnel within districts; performance evaluation and discipline of personnel after appropriate consultation; responsibility for the physical condition of district facilities; development of community relationships within districts; designation of working groups to serve areas within districts, and information and recommendations of programs. The district also relates health and program needs and makes recommendations for the employment of enforcement sanctions where necessary.

It was recognized that certain types or portions of programs might not be amenable to administrative decentralization. These exceptions related to certain research programs, operations in the developmental or testing phase, temporary emergency action, services for which public need and convenience required central office location, activities for special groups or of a highly specialized nature, for which duplication throughout the city was unnecessary or uneconomical.

In order to facilitate the change of structure and to serve the districts, an office of district health operations was created. The director of this office is the line supervisor of the district health directors and is responsible to the director of public health services for their professional direction and supervision. The office of district health operations provides many housekeeping functions for the districts such as control of expenditures and provision of facilities. This office also helps focus attention on district operational problems and assists in their solution.

Working Together

To further the principle of working closely together, both the personnel in district offices and central divisions have been specifically directed to engage freely in personal and telephone communication with each other. Some might question this as contributing to chaos, but in practice it helps eliminate unnecessary "red tape" and adds to efficiency. It also creates better understanding. Of course, such free communication requires comprehension of relative responsibilities and mutual respect for each other's prerogatives.

This plan has resulted in many benefits to the environmental health program as well as to the department as a whole. The central divisions relieved of direct responsibility for day-to-day operations can now function in program planning, evaluation, and direction. The district health director takes more interest in environmental health problems. The team approach is enhanced as the sanitarians become more involved in the health program in the district.

We anticipated problems arising from a change of this magnitude in administrative operation. When the nature of the problems became apparent, the director of public health services established a general advisory staff council on operations with the power to implement changes in the interests of smoother operations. This council later became known as the Co-Op Council. At present, this group is composed of a district health director, the director of district health operations, the administrative assistant to the director of public health services, the director of the division of nursing, and the chief of the section of maternal and child health. The director of the division of environmental health is the director of the council.

Problems selected for consideration by this council have been those concerned with a principle which might be applicable to other situations of a similar nature; thus the council does not expect to develop standard operating procedures for every conceivable condition. The assumption is that persons at high levels in the department are sufficiently intelligent to extend a principle enunciated in a particular exercise to other situations appearing in the future.

Typical of the kind of problems explored and solved by the Co-Op Council are the scheduling of clinics and procedures for inservice training. Under consideration are matters of budget administration, programing, and communications.

Anticipated Difficulties

While these illustrate specific problems which have been tackled in a specific manner, there are other general questions one should anticipate which have to be solved to assure the success of administrative decentralization. Recognition of these issues and their resolution has contributed to the ease of transition in the Philadelphia decentralization.

A point of general concern has been the role of the office of district health operations. It is difficult in the establishment of an office such as this to avoid duplication of the staffs of the various central divisions. Since such an office is in a line position with respect to the district health directors, there is a tendency to assume directory responsibility for formulation of programs. As the personnel in the central divisions are the most competent in the department in their respective fields, it seems important to preserve their responsibility for program direction. Accordingly, the function of the office of district health operations should be that of service. Recognition by the director of district health operations of this role of service rather than of program formulation is important in the establishment of the proper working relationship.

Another area of understanding involves the relative roles of central program directors and the district health directors responsible for operations. It is difficult for the district director to recognize his position as administrator and to submerge a tendency to exercise his technical competence regarding standards and procedures. He should recognize that he is now an administrator and function in this capacity. A great deal of friction can be avoided if this individual refrains from passing on the validity of technical standards and procedures. While he may question some of the directives given to him, he should accept the final decision.

On the other hand, the central program directors should not operate in ivory towers. They must have information and comments from district personnel in order to be apprised of the citywide problems. The district workers are in a position through experience and intimate community contact to know which programs are workable and which impracticable. In program planning these persons must be consulted and their views considered by the central programing personnel.

It is difficult for the central program director to surrender his privilege of directing daily operations. There is a tendency for him to feel that direct supervision is necessary in order to obtain his objectives. It requires considerable maturity on the part of the program director to recognize that he can multiply his efforts by concentrating them in the area where he is best qualified, and permitting others to carry out the day-to-day operations according to his plan.

The most fundamental issue in the introduction of a drastic change of this type is its acceptance by personnel at all levels. In looking back over our experience, we believe that acceptance has been enhanced by the work of the COOLS Committee and the Co-Op Council. The personnel at least know that their points of view have been considered, whether accepted or not. The discussions, while they may not always have brought agreement, have in most instances developed understanding.

On the basis of 3 years' experience with a statewide noncompulsory immunization law for school children, Indiana State health officials predict satisfactory levels of immunization in a few years.

A NONCOMPULSORY IMMUNIZATION LAW FOR INDIANA SCHOOL CHILDREN

A. L. Marshall, Jr., M.D.
Andrew C. Offutt, M.D., L.L.D.

IN 1957, a bill was introduced in the Indiana General Assembly calling for compulsory immunization of all children entering school for the first time. Indiana has never had a compulsory immunization law. The bill as introduced provided for immunization of all children against smallpox, diphtheria, tetanus, pertussis, and poliomyelitis.

Fortunately the State health commissioner and members of his staff were called to testify at the committee hearings on the bill. The Indiana State Board of Health has for many years emphasized the need to immunize children between birth and 6 months of age because during this age period the diseases against which protection can be given by immunizing biologicals are the greatest hazard to the young child. All educational efforts with the laity and the medical profession have been directed toward early immunization. The passage of a compulsory law such as the one proposed would tend to cause a reversion to the former practice of sending children to school to be immunized instead of immunizing children before they attend school. It was also pointed out that the decision to obtain protection against disease through immunization must be made by the individual, his family, and the family physician, and that the decision should be made voluntarily on the basis of the value and benefits to be derived.

The legislators rewrote the entire bill and it became law July 1, 1957, with the following provisions:

> The school officials of each school corporation in the State of Indiana shall, upon enrollment of any child for the first time in any school of the school corporation, require the parents, guardian, or any person having the control and custody of such child, if they do not object thereto in writing, to furnish a written statement stating therein whether or not such child has been immunized against smallpox, diphtheria, whooping cough, tetanus or poliomyelitis. The statement shall contain a recital showing the age of such child at the time he received such immunization.
>
> The school officials of the several school corporations of this State shall, not later than sixty days after the enrollment of children for the first time, in any school of the school corporation, file a written report with the Indiana State Board of Health of the Division of Health and Preventive Medicine, and the local health officer having jurisdiction in a manner as may be prescribed by the State board of health, stating in the report the number of such children who have or have not been immunized against smallpox, diphtheria, whooping cough, tetanus or poliomyelitis. The report shall recite the names of the children who have been so immunized and the age when said children received such immunization; and the report shall also recite the names of any children who have not been so immunized. The Indiana State Board of Health shall prescribe and provide the forms on which the school officials shall make such report.

Dr. Marshall serves as director of the division of communicable disease control of the Indiana State Board of Health. Dr. Offutt is secretary of the board and State health commissioner.

Table 1. Percentage of Indiana pupils beginning school immunized against diseases covered in the State's immunization law of 1957, as reported to the State board of health

Year	Pupils	Smallpox	Diphtheria	Tetanus	Whooping cough	Poliomyelitis
1957	104, 949	65	72	71	71	67
1958	100, 713	64	73	71	71	69
1959	99, 843	67	75	75	74	73

Data Gathering

Many of the schools in Indiana were already using a questionnaire which was filled out by the parent or guardian of each child entering school for the first time. This included questions on immunization. Letters were sent by the Indiana State Board of Health to the superintendent of each school system in the State asking them to include such questions in their entrance questionnaire.

The principal of each school was asked by the superintendent of schools to report the number of pupils entering school for the first time and the number who were satisfactorily immunized against poliomyelitis, pertussis, diphtheria, tetanus, and smallpox. A sample form was sent to each school principal indicating the manner in which the data should be presented when reported to the school superintendent. It was left to the decision of each superintendent as to whether his principals would be supplied printed forms for this report or whether the information was to be transmitted by letter.

The Indiana State Board of Health supplies a form in triplicate to the school superintendents. On this form the superintendent lists all of the schools under his control. Pertinent data are given as to the number of pupils entering school for the first time and the number satisfactorily immunized against each disease named in the law. The original copy of the form is sent to the State board of health and the second copy to the local health officer. The third copy is retained by the school superintendent.

The communicable disease control division of the Indiana State Board of Health receives these reports, collates them, and publishes an annual report of the State by counties. Copies are mailed to every school superintendent and local health officer in the State. The report for the calendar year 1959 has just been completed. A summary of the totals for the 3 years the

Table 2. Status of immunization as reported by counties in Indiana, by percent of immunized first graders in public and parochial schools

Percent of first graders immunized	Number of counties reporting														
	Smallpox			Diphtheria			Tetanus			Pertussis			Poliomyelitis		
	1957	1958	1959	1957	1958	1959	1957	1958	1959	1957	1958	1959	1957	1958	1959
20–30	5	2	2					1			1				
30–40	10	8	5		1	1	2		1	2		1	2	1	1
40–50	16	17	12	5	3	2	8	5	2	4	2	1	6	3	1
50–60	22	21	19	13	11	7	13	9	9	14	15	6	23	11	4
60–70	24	22	25	25	27	21	30	30	18	32	32	21	34	40	27
70–80	11	14	22	38	37	37	28	35	40	30	29	41	22	28	39
80–90	2	6	5	9	9	21	9	10	18	9	11	19	4	8	19
90–100	1	1	2	1	3	3	1	1	4		1	3			1
Total	91	91	92	91	91	92	91	91	92	91	91	92	91	91	92

NOTE: Brown County gave no reports for 1957 and 1958.

law has been in operation shows some slight improvement in the status of immunization against all preventable diseases (table 1).

The Monthly Bulletin

Following each year's tabulation a short article is written for the *Monthly Bulletin*, a publication of the Indiana State Board of Health. Accompanying each of these articles are charts indicating the percent of first graders immunized in each county. Counties with less than a 70 percent level of immunity are shaded; others are white.

The results of 3 years' experience have shown that parents have to answer their children when they ask: "Why haven't I had smallpox or polio shots?" After the second annual report in the *Monthly Bulletin*, parents began to take action in their PTA groups, through their local health departments, and through other civic groups to raise the immunization standards in their communities so that their county will appear white on the State chart.

The State's citizens have been taking steps to help themselves. The Indiana State Medical Association went on record in 1955 as opposed to the general principle of mass immunization except in times of emergency or disaster. In many areas where the number of first grade pupils protected against preventable diseases was shockingly low, the physicians were as surprised and concerned as the parents. In fact, during the last 6 months, mass immunizations have been planned in several areas by the local health department and the parents with the sanction and cooperation of the local medical society. These programs for the most part are paid for from local funds, as the State board of health under existing statutes can provide biologicals only for the indigent. The State board of health has been able to assist in some of these programs by an arrangement whereby the pharmaceutical house holding the State contract for biologicals sells to local health departments immunizing biologicals at the State price. The State medical society has taken cognizance of the problem by urging physicians to take steps to promote immunizations in their offices. The number of counties achieving higher immunization levels has increased (table 2).

The figures for the third year's report are in the printer's hands. It is expected that the publication of the *Monthly Bulletin* carrying these data will stimulate even greater local activity than evidenced by the second year's report.

Conclusion

There has been a movement in the United States in the past 2 years to make immunization compulsory upon entering school. The Indiana State Board of Health feels not only that the compulsory aspect will discourage immunizations early in life but that the preservation of health is an individual or family responsibility. Based upon the short experience with the Indiana law it is believed that within a relatively few years this type of legislation will result in the achievement of a satisfactory immunization level for children in all counties of the State. This experience with a noncompulsory immunization law may be of benefit to States in which pressure groups are clamoring for compulsory immunization.

Recommendations for a control program based on preventive medicine

Bovine Mastitis

IN SPITE of improvements in dairy husbandry practices, the availability of a wider range of therapeutic agents, and the efforts of health and agriculture authorities toward control, bovine mastitis continues as a major problem in the dairy industry. The problem is twofold, encompassing both public health hazards to man and economic losses to the dairyman.

A variety of micro-organisms that produce disease in man also inhabit the bovine udder and cause mastitis. Although certain streptococci and staphylococci are considered to be the primary infectious causes of mastitis, numerous other organisms have been shown to be involved, such as *Escherichia coli*, *Corynebacterium pyogenes*, *Pasteurella multocida*, *Mycobacterium bovis*, and many others (see list of infectious causes).

Human infection may result from direct contact with the infected animal or consumption of raw or inadequately pasteurized milk containing pathogenic organisms. Of further public health importance are the staphylococcal enterotoxins in milk which are not destroyed by pasteurization. As a result, fluid milk, dried milk, and cheese have been incriminated in outbreaks of food poisoning in man.

These recommendations were prepared by Dr. James H. Steele, chief, and Dr. Raymond Zinn, Dr. Robert Courter, and Mildred M. Galton of the Veterinary Public Health Section, Communicable Disease Center, Public Health Service, with the advice of Dr. William Pounden, Ohio Agricultural Experimental Station, Wooster; Dr. John Helwig, Dr. David Jones, and Dr. Charles Reid, Department of Preventive Veterinary Medicine, Ohio State University, Columbus; and Dr. Joe W. Atkinson, Milk and Food Program, Public Health Service.

It has been demonstrated also that milk from cows with mastitis is low in nutritional value and quality. During the past decade the widespread use of antibiotic therapy in mastitis, with the resultant antibiotic residues in milk and milk products from these treated animals, has presented still another possible health hazard. Nonsensitive individuals may become sensitized and hypersensitive persons may have reactions.

Also of importance is the economic loss caused by bovine mastitis, which is estimated to be more than a quarter of one billion dollars annually. This loss is due to lower milk production, a reduction in the productive life of the affected cows, mortality of some animals, and, finally, the expense of veterinary services and drugs.

Predisposing Causes

There are many predisposing or initiating causes of bovine mastitis that are difficult to control, particularly in the small herds where dairying is only one of several farming activities. Such contributing factors include:

- Sloppy, muddy barnyards.
- Unsanitary milking barns.
- Inadequate, drafty shelter.
- Injuries or bruises caused by faulty milking machines, freezing or chapping of teats, and structural features such as high doorsills, narrow, short stalls, protruding nails, and poor fences.
- Improper milking practices such as incomplete or irregular milking, unclean machines, failure to dip teat cups after use on each cow, inaccurate pressure gauge or pressure too high for type of teat cup used, leaving machine on cow too long, failure to segregate cows, milking cows in improper order, improper cleansing of cow before milking, and "wet stripping."
- Physical abnormalities of udder or teats.
- Age of cow.
- Hereditary factors.

• Lack of attention or treatment during "dry periods."

In maintaining an adequate inspection program, there must be complete cooperation between the dairyman, the veterinarian, the processor, and the health department. Neither the prevalence of mastitis nor economic losses can be significantly reduced by treatment of acute cases alone. Any effective program for the control of mastitis must be based on consideration of the total herd.

Recommended Preventive Program

A routine, continuous check or supervision system by a qualified individual has been applied in some of the larger dairies and has proved both successful and profitable. It provides periodic examination of all milking and dry cows in the herd, including all aspects of prevention, diagnosis, and treatment. If a similar system could be applied in the smaller dairies, it should be equally effective. Factors to consider in the continuous check system are:

Biological factors. One infected cow in a herd constitutes a potential hazard, and laboratory examination is essential to determine the etiological agent and effectively cope with it.

Environmental factors. For the most part, environmental factors which influence the health of the herd may be controlled by the application of good sanitation and milking practices as well as by properly designed and maintained equipment. The health of workers who have close contact with the herd must be considered also in an effort to prevent transmission of infections from man to animal.

Herd management. The dairying operation should be planned to provide satisfactorily constructed housing and equipment which will lend itself to effective sanitation measures with the most efficient use of labor. Replacement stock should be carefully selected to minimize the opportunities of introducing infection into the milking herd. Such a continuous program, with careful attention to feeding and milking practices, is essential in the maintenance of a healthy herd.

Infected herds should be followed closely until prevalence of disease and losses are reduced to a minimum. Otherwise, visits to the herds should be scheduled at regular intervals so as to maintain this minimum rate.

Such a system of professional care will assure identification of chronic and acute cases, accurate diagnosis, advice on procedures and continuing remedial measures for infected herds, and specific treatment for infected cows. Also, it will provide dairymen with long-range advice on heredity, breeding programs, nutrition, and other factors related to herd health. A healthy herd assures wholesome, good quality milk and thus reduces public health hazards and economic losses.

Preventive Methods

Effective Controls

Institute a periodic examination by a veterinarian of all milking and dry cows in the herd:

1. To determine general health of each cow.
2. To examine udder for lumps and injuries.
3. To collect milk samples from all cows in the milking string for laboratory examination.
4. To discuss and advise on herd practices, sanitation, nutrition, and other factors related to mastitis prevention and control.

Segregation of Infected Animals

Isolate cows with mastitis and milk separately (if practical) or milk cows in the following order:

1. Cows with no evidence of mastitis.
2. Cows with normal udders, but shedding mastitis bacteria as shown by culture of milk samples.

Infectious Causes

Streptococcus agalactiae
Streptococcus dysgalactiae
Streptococcus pyogenes
Staphylococcus aureus
Escherichia coli
Aerobacter aerogenes
Klebsiella pneumoniae
Pseudomonas aeruginosa
Corynebacterium pyogenes
Pasteurella multocida
Clostridium perfringens
Nocardia asteroides
Cryptococcus neoformans
Mycobacterium bovis (tuberculosis)
Paracolon bacteria
Salmonella serotypes
Actinomyces bovis
Brucella abortus
Brucella melitensis
Leptospira pomona

3. Cows with udders showing some physical evidence of past or present mastitis.

4. Cows with acutely affected or badly damaged udders as a result of severe infections.

Disposition of Mastitic Mammary Secretions

In all cases of disease, suspected disease, or treatment, obtain the advice of the veterinarian on disposition of milk from the affected cows.

1. Dispose of mammary secretions abnormal in appearance or from obviously infected quarters so they are not accessible to animals or used in any way for human consumption.

2. Discard from market milk supply secretion from quarters infused with antibiotics for at least 72 hours following last infusion.

Sanitation and Good Milking Practices

1. Avoid sloppy and muddy barnyards.
2. Maintain milking barn in clean condition.
3. Keep the udder trimmed of long hair.
4. Have a regular milking schedule.
5. About 1 minute before milking, wash udder with a warm solution containing at least 200 ppm available chlorine. Use a separate clean towel and do not dip or place a used towel back in the solution.
6. Use a strip cup or plate.
7. Use the milking machine properly; follow manufacturer's instructions.
8. Keep teat cup liners clean and in good repair.
9. Put machine on cow as soon as the "let down" occurs; take it off as soon as the milk is removed from the udder.
10. Strip rapidly by machine or hand.
11. Immediately after milking, dip teats in an approved mild antiseptic solution or swab teat ends with mild antiseptic.
12. After removal from each cow, dip teat cups in lukewarm water or antiseptic solution, then in a fresh warm chlorine (200 to 250 ppm) or other approved antiseptic solution.
13. Wash hands frequently; do not permit "wet-hand" milking.
14. Disinfect stalls where cows with mastitis are kept.

Good Herd Management

1. Use home-raised heifers as replacements; or have each purchased replacement thoroughly examined by a veterinarian, have milk samples from each quarter of the udder analyzed, and isolate the animal until sure she is free of mastitis.
2. Construct milking barn to allow plenty of standing room; have no steps at all or very low steps at doorways.
3. Keep barnyards, barn, and pastures free of mud, trash, debris, machinery, and other sources of filth or injury.
4. Be sure stall beds are of adequate size, neither too narrow nor too short, with partitions or curbs between cows.
5. Provide plenty of clean bedding, preferably straw or a mixture containing straw.
6. Clean and disinfect cow beds periodically.
7. Drying off cows:
   (*a*) Reduce grain and water intake of heavy producers.
   (*b*) Stop milking, except to relieve the udder when it seems too full.
   (*c*) If mastitis is present, keep pus or infected secretions milked out; treat.
   (*d*) Allow 8 weeks as a minimum dry period, and as much as 3 months for cows known to have had mastitis.
   (*e*) Observe frequently during the dry period, and obtain veterinary advice and treatment when needed.
8. Remove from the herd cows which are in heat to prevent the animals from mounting each other and bruising their udders.
9. Do not allow calves to suck each other.
10. Do not feed calves raw milk from cows with mastitis.
11. Feed calves pasteurized milk.
12. Reduce the concentrated feed intake of a cow with mastitis.
13. Be sure that diagnosis is specific, that treatment is correct, effective in amount, and continued for sufficient length of time, and that all other needed remedial action is carried out for prevention of mastitis within the entire herd.

Milk Sanitation Honor Roll for 1958–60

Fifty communities have been added to the Public Health Service milk sanitation "honor roll," and 74 communities on the previous list have been dropped. This revision covers the period from July 1, 1958, to June 30, 1960, and includes a total of 281 cities and 90 counties.

Communities on the honor roll have complied substantially with the various items of sanitation contained in the milk ordinance recommended by the U.S. Public Health Service. The State milk sanitation authorities concerned report this compliance to the Service. The rating of 90 percent or more, which is necessary for inclusion on the list, is computed from the weighted average of the percentages of compliance. Separate lists are compiled for communities in which all market milk sold is pasteurized, and for those in which both raw milk and pasteurized milk are sold.

The recommended milk ordinance, on which the milk sanitation ratings are based, is now in effect through voluntary adoption in 496 counties and 1,426 municipalities. The ordinance also serves as the basis for the regulations of 36 States. In 16 States it is in effect statewide.

The ratings do not represent a complete measure of safety, but they do indicate how closely a community's milk supply conforms with the standards for grade A milk as stated in the recommended ordinance. High-grade pasteurized milk is safer than high-grade raw milk because of the added protection of pasteurization. The second list, therefore, shows the percentage of pasteurized milk sold in a community which also permits the sale of raw milk.

Although semiannual publication of the list is intended to encourage communities operating under the recommended ordinance to attain and maintain a high level of enforcement of its provisions, no comparison is intended with communities operating under other milk ordinances. Some communities might be deserving of inclusion, but they cannot be listed because no arrangements have been made for determination of their ratings by the State milk sanitation authority concerned. In other cases, the ratings which were submitted have lapsed because they are more than 2 years old. Still other communities, some of which may have high-grade milk supplies, have indicated no desire for rating or inclusion on this list.

This compilation is from the Milk and Food Program, Division of Engineering Services, Public Health Service. The previous listing was published in Public Health Reports, April 1960, pp. 371–374. The rating method is described in PHS Publication No. 678 (Methods of Making Sanitation Ratings of Milksheds).

The rules for inclusion of a community on the honor roll are:

1. All ratings must be determined by the State milk sanitation authority in accordance with the Public Health Service rating method, which is based on the grade A pasteurized milk and the grade A raw milk requirements of the Public Health Service recommended milk ordinance.

2. No community will be included on the list unless both its pasteurized milk and its retail raw milk ratings are 90 percent or more. Communities in which only raw milk is sold will be included if the retail raw milk rating is 90 percent or more.

3. The rating used will be the latest submitted to the Public Health Service, but no rating will be used which is more than 2 years old. (In order to promote continuous rigid enforcement rather than occasional "cleanup campaigns," it is suggested that, when the rating of a community on the list falls below 90 percent, no resurvey be made for at least 6 months. This will result in the removal of the community from the subsequent semiannual list.)

4. No community will be included on the list whose milk supply is not under an established program of official routine inspection and laboratory control provided by itself, the county, a milk-control district, or the State. (In the absence of such an official program, there can be no assurance that only milk from sources rating 90 percent or more will be used continuously.)

5. The Public Health Service will make occasional check surveys of cities for which ratings of 90 percent or more have been reported by the State. (If the check rating is less than 90 percent, but not less than 85, the city will be removed from the 90-percent list after 6 months unless a resurvey submitted by the State during this probationary period shows a rating of 90 percent or more. If the check rating is less than 85 percent, the city will be removed from the list immediately. If the check rating is 90 percent or more, the city will be retained on the list for 2 years from the date of the check survey, unless a subsequent rating during this period warrants its removal.)

Communities awarded milk sanitation ratings of 90 percent or more, July 1958–June 1960

100 PERCENT OF MARKET MILK PASTEURIZED

Community	Date of rating
Arkansas	
Fort Smith	8– 7–1959
Colorado	
Boulder County	5–––1960
Denver and Denver County	5–––1959
Las Animas-Huerfano Counties	1–––1960
Pueblo County	8–13–1959
Weld County	7–23–1959
District of Columbia	
Washington	12–11–1959
Georgia	
Albany	12– 5–1958
Athens	5– 8–1959
Atlanta	8– 6–1959
Augusta	5–23–1959
Brunswick	11– 9–1959
Cairo	3–22–1960
Calhoun-Gordon County	8–12–1958
Canton	10–30–1958
Columbus	1–23–1959
Dalton	2– 5–1960
Douglas County	7–25–1958
Fitzgerald	5–27–1959
La Grange	10– 8–1958
Moultrie	12–10–1959
Paulding County	7–25–1958
Quitman	3–16–1960
Rome-Floyd County	8– 6–1959
Savannah	7–18–1958
Thomasville	3–18–1960
Valdosta	12– 9–1959
Waycross	3–11–1960
Illinois	
Chicago	5– 4–1959
Elgin	9–19–1958
Joliet	3–27–1959
Indiana	
Anderson	12– 3–1958
Berne-Bluffton area	10–17–1958
Fort Wayne	7–15–1958
Frankfort	2–10–1959
Huntington	1–14–1959
Kokomo	2–10–1959
Madison	7–23–1958
Indiana—Continued	
Monticello	10–16–1958
North Manchester	12–16–1958
Peru	10–30–1958
Rochester	9–17–1958
Warsaw	8–15–1958
Iowa	
Ames	3–15–1960
Anamosa	12– 9–1959
Atlantic	10– 7–1959
Boone	3– 4–1960
Burlington	3–17–1960
Cedar Falls	11–25–1959
Cedar Rapids	10– 9–1958
Clarion	10–22–1959
Clinton	8–27–1959
Corydon	2– 2–1960
Davenport	7–24–1958
Des Moines	7– 3–1958
Dyersville	12– 8–1959
Eagle Grove	10–19–1959
Estherville	7– 8–1959
Fort Dodge	7–29–1959
Grinnell	7– 1–1959
Humboldt	10–20–1959
Iowa City	10– 9–1958
Le Mars	1–28–1960
Lytton	10–21–1959
Maquoketa	12– 9–1959
Marshalltown	10–21–1959
Mason City	1–20–1960
Pocahontas	10–20–1959
Rockwell City	10–21–1959
Spencer	2–26–1960
Storm Lake	10–14–1959
Waterloo	11–20–1959
Webster City	10–19–1959
Kentucky	
Ashland and Boyd County	7–23–1959
Bell County	8– 4–1959
Benton	3– 2–1960
Bowling Green and Warren County	5–14–1959
Campbellsville	2–13–1959
Covington	5–28–1959
Danville and Boyle County	2–11–1960
Elizabethtown and Hardin County	11–23–1959
Kentucky—Continued	
Frankfort	10– 8–1959
Fulton and Fulton County	8–12–1959
Glasgow	1–17–1959
Georgetown and Scott County	10– 9–1959
Greenville	3–30–1960
Hardinsburg and Breckinridge County	10–22–1958
Henderson County	7–10–1959
Hodgenville	10–20–1958
Hopkinsville and Christian County	4–21–1960
Jessamine County	6–17–1959
Liberty	11–18–1958
Louisville and Jefferson County	12–11–1959
Lyon County	3– 1–1960
Mayfield and Graves County	5– 6–1959
McLean County	3–28–1960
Morehead	2– 3–1959
Morgantown	11–24–1959
Mount Sterling	6–16–1959
Murray and Calloway County	1– 7–1960
Newport and Campbell County	9–18–1959
Owensboro	2– 5–1960
Owingsville	6–16–1959
Paducah and McCracken County	5– 1–1959
Paris and Bourbon County	6–15–1959
Pike County	7–22–1958
Prestonsburg and Floyd County	7–22–1958
Russellville	2– 2–1960
Smithland and Livingston County	3– 1–1960
Mississippi	
Amory	5– 7–1959
Biloxi	10– 8–1959
Booneville	5– 6–1959
Brookhaven	1–26–1960
Canton	9–30–1958
Clarksdale	12–17–1958
Columbia	8– 7–1958
Columbus	7–16–1958
Corinth	4– 9–1959
Eupora	9–24–1959

Communities awarded milk sanitation ratings of 90 percent or more, July 1958–June 1960—Continued

Community	Date of rating
Mississippi—Continued	
Greenville	10–21–1958
Greenwood	2– 2–1960
Grenada	9–17–1959
Gulfport	10– 8–1959
Hattiesburg	2–23–1960
Hernando	12–19–1958
Houston	4–15–1959
Iuka	4– 8–1959
Jackson	3–26–1959
Laurel	3–17–1960
Louisville	8–18–1958
Meadville	2–25–1959
Meridian	11–18–1959
New Albany	8–27–1959
Oxford	7– 2–1959
Picayune	6–11–1959
Starkville	2–10–1959
State College	2–11–1959
Tupelo	1–27–1959
Vicksburg	1–27–1959
West Point	7–15–1958
Missouri	
Chillicothe	8–19–1959
Hannibal	8–17–1959
Kansas City	10–27–1959
St. Joseph	1–27–1960
St. Louis	6–29–1959
Sikeston	12–10–1959
Nebraska	
Lincoln	7–16–1958
Nevada	
Clark, Nye, and Lincoln Counties	5–18–1959
New Mexico	
Albuquerque	9–11–1958
North Carolina	
Alexander County	1– 9–1959
Beaufort County	5–14–1959
Burke County	4–27–1960
Catawba County	1– 9–1959
Craven County	7–24–1959
Cumberland County	11–27–1959
Durham County	12–18–1959
Edgecombe County	9–10–1959
Forsyth County	12–12–1958
Gates County	7–31–1958
Guilford County	11–20–1959
Halifax County	6–22–1959
North Carolina—Continued	
Harnett County	10–15–1958
Haywood County	3–30–1960
Henderson County	10–20–1958
Hertford County	7–31–1958
Iredell County	12–11–1959
Jackson County	3–19–1959
Lee County	4–26–1960
Lenoir County	4– 7–1959
Lincoln County	1– 9–1959
Macon County	3–19–1959
Martin County	8–13–1958
Mecklenburg County	10–23–1959
Montgomery County	4– 7–1960
Nash County	10–14–1959
New Hanover County	12–10–1959
Northampton County	7–31–1958
Onslow County	5–13–1959
Pamlico County	8–28–1959
Pender County	3– 2–1959
Richmond County	7–30–1958
Rocky Mount	10–14–1959
Stanly County	9–10–1958
Swain County	3–19–1959
Transylvania County	10–20–1958
Tyrrell County	2–18–1960
Union County	12– 4–1958
Washington County	2–18–1960
Wayne County	11– 5–1959
Wilson County	8–28–1959
Oklahoma	
Mangum	11–12–1959
Okmulgee	10–16–1959
Tulsa	6–15–1959
Tennessee	
Athens	9– 3–1959
Chattanooga-Hamilton County	10– 9–1958
Cleveland	9– 2–1959
Clinton	9–16–1958
Covington	12–12–1958
Cowan	10–16–1958
Decherd	10–16–1958
Dyersburg	11–18–1958
Erwin	10–30–1958
Greeneville	4–27–1960
Humboldt	11– 5–1958
Huntingdon	10–28–1958
Jackson-Madison County	10–14–1958
Kingsport	1–20–1960
Knoxville	5– 6–1959
Tennessee—Continued	
Lexington	10–30–1958
Livingston	1– 7–1959
Manchester	10–15–1958
Maryville and Alcoa	3–29–1960
Memphis	8–18–1959
Milan	11–11–1958
Morristown	7–10–1958
Mountain City	10–28–1958
Murfreesboro	7–21–1959
Nashville-Davidson County	10–21–1959
Newbern	11–18–1958
Paris	9– 4–1958
Pulaski	8– 3–1959
Sweetwater	9–23–1958
Trenton	11– 5–1958
Tulahoma	10–13–1958
Waverly	8–26–1958
Winchester	10–16–1958
Texas	
Amarillo	4–14–1959
Big Spring	8–21–1959
Brownfield	6– 9–1959
Brownwood	6–29–1959
Bryan	7–17–1959
Burkburnett	8–11–1959
College Station	7–16–1959
Corpus Christi	5–11–1959
Dallas	11–17–1958
Denver City	6– 8–1959
Edinburg	1–25–1960
El Paso	9–11–1959
Falfurrias	9–10–1959
Fort Worth	5–28–1959
Gonzales	7–24–1959
Grand Prairie	11–28–1958
Greenville	12–12–1958
Harlingen	9–10–1959
Jacksonville	12–17–1958
Kingsville	5– 6–1959
Levelland	6–11–1959
Lubbock	8–14–1958
Lufkin	7– 9–1958
McAllen	1–26–1960
Mercedes	1–26–1960
Midland	8–21–1959
Mineral Wells	7–10–1959
Odessa	8–21–1959
Paris	3–11–1960
Plainview	10– 8–1958
San Angelo	9– 4–1959
San Antonio	3– 6–1959

Communities awarded milk sanitation ratings of 90 percent or more, July 1958–June 1960—Continued

Community	Date of rating
Texas—Continued	
San Benito	9–10–1959
Seagraves	6– 8–1959
Seminole	6– 8–1959
Sweetwater	9–25–1959
Texarkana	6–24–1959
Tyler	9–26–1958
Victoria	1–19–1959
Wichita Falls	10–23–1959
Utah	
Ogden	2–25–1960
Utah County	3–23–1960
Virginia	
Alexandria	6–10–1959
Blacksburg	8– 7–1958
Christiansburg	8– 7–1958
Colonial Heights	11– 7–1958
Virginia—Continued	
Lynchburg	4–14–1959
Marion	4–22–1959
Norfolk	6– 3–1960
Petersburg	11– 7–1958
Portsmouth	3–27–1959
Pulaski	8– 7–1958
Radford	8– 7–1958
Richmond	4–25–1960
Roanoke	7– 3–1958
South Boston	5–13–1959
Staunton	3– 8–1960
Waynesboro	4–21–1960
Washington	
Everett	10–28–1959
Spokane	10–29–1958
Tacoma	8–25–1959
Whitman County	10–17–1958
Wisconsin	
Appleton	1–13–1959
Beaver Dam	2–13–1959
Burlington	12–11–1958
Delavan	12–11–1958
Eau Claire County (Eau Claire, Altoona, Augusta, and Fairchild)	2– 3–1959
Elkhorn	12–11–1958
Fontana	12–11–1958
Fort Atkinson	12–11–1958
Kaukauna	1– 6–1959
La Crosse	8–26–1958
Lake Geneva	12–11–1958
Neenah-Menasha	12– 2–1958
Oshkosh	7– 9–1958
Ripon	2–13–1959
Stevens Point	2–19–1959
Waupun	2–13–1959
Williams Bay	12–11–1958

BOTH RAW AND PASTEURIZED MARKET MILK

Community and percent of milk pasteurized	Date of rating
Arkansas	
Little Rock, 99.8	10–14–1959
Georgia	
Americus, 94.9	8–25–1958
Carrollton, 99.8	2–12–1959
Gainesville, 95.6	9–19–1958
Macon, 99.85	11– 9–1959
Newnan, 99	11–20–1959
Toccoa, 97.4	12–19–1958
Washington, 99.87	2–25–1959
Kentucky	
Madisonville and Hopkins County, 99	12–11–1958
Somerset and Pulaski County, 96	8–29–1958
North Carolina	
Buncombe County, 99.1	9–30–1959
Cleveland County, 91.8	9–11–1958
Robeson County, 98.2	2–24–1960
Oklahoma	
Lawton, 99.5	1–15–1959
Shawnee, 98.98	1–29–1960
Oregon	
Portland, 99.9	9–18–1959
Texas	
Abilene, 99.67	7– 2–1959
Austin, 99.9	11–19–1959
Brenham, 95.5	7–11–1958
Brownsville, 99.3	8–27–1959
Denton, 97.7	7–30–1959
Texas—Continued	
Hereford, 97	3–27–1959
Laredo, 96.6	6– 9–1959
Marshall, 98.8	4–23–1959
Palestine, 99.79	7–10–1959
Waco, 99.97	9–25–1959
Virginia	
Charlottesville, 99.7	10–15–1959
Washington	
Benton and Franklin Counties, 99.7	9–25–1958
Seattle-King County, 99.7	5–12–1959
West Virginia	
Kanawha County, 99.3	8–29–1958

NOTE: In these communities the pasteurized market milk shows a 90 percent or more compliance with the grade A pasteurized milk requirements, and the raw market milk shows a 90 percent or more compliance with the grade A raw milk requirements, of the milk ordinance recommended by the U.S. Public Health Service.

Notice particularly the percentage of the milk pasteurized in the various communities listed. This percentage is an important factor in estimating the safety of a city's milk supply. All milk should be pasteurized, whether commercially or at home, before it is consumed.

Federal Publications

Highlights of Progress in Mental Health Research, 1959. *PHS Publication No. 736; 1960; 51 pages; 25 cents.*

Significant developments in mental health research conducted and supported by the National Institute of Mental Health, Public Health Service, are described briefly.

The material, arranged under 14 classifications, reflects increased activity in the biological and sociological disciplines concerned with mental health, along with continued high interest in psychological studies.

Topics include pathology, biochemistry, psychopharmacology, metabolism, the brain, family relationships, child development, aging, alcoholism, the mental hospital, and community mental health services.

Highlights of Research Progress in Allergy and Infectious Diseases, 1959. *PHS Publication No. 745; 1960; 53 pages; 25 cents.*

Significant research accomplishments in 53 intramural and grant-supported projects of the National Institute of Allergy and Infectious Diseases, Public Health Service, are described briefly. Major subjects include allergy-immunology, cell biology, and bacterial, parasitic, fungus, and rickettsial diseases.

Areas of special interest include establishment of a program aimed at standardization of allergens, sponsorship of a symposium on encephalitis, and the first international congress on the relationship of pleuropneumonia-like organisms to human disease.

Progress Against Cancer, 1959. *PHS Publication No. 738; 1960; 61 pages; 25 cents.*

Fifty-five summaries of research findings by National Cancer Institute and grantee scientists present highlights in research progress and program developments during 1959. They are organized under 11 headings: virus studies, environmental carcinogens, tumors in laboratory animals, studies at the cellular level, biochemical studies, cancer detection, radiation research, leukemia studies, chemotherapy research, and survival of cancer patients. Cancer courses and the laboratory demonstration conference for teachers are described in a section on special training.

The material was originally prepared for presentation at congressional hearings on appropriations. The opening statement by the director of the National Cancer Institute to the appropriations committees is included.

Insecticidal Equipment for the Control of Insects of Public Health Importance. *PHS Publication No. 774; 1960; by Harold G. Scott and Kent S. Littig; 33 pages; 25 cents.*

This training guide discusses equipment used in vector control, from hand dusters and compressed air sprayers to large power-driven fog and mist machines. Spray nozzles and their calibration with actual spray output are covered in one section.

The broad principles of operating the machines and the influence of atmospheric conditions are stressed. Fifteen line drawings, selected references, and a list of films augment the text.

Tuberculosis. Laboratory methods in diagnosis. *PHS Publication No. 770; 1960; 80 pages; 35 cents.*

Some of the more common laboratory methods used in the isolation and identification of tubercle bacilli and the unclassified (atypical) acid-fast bacilli are presented.

In addition to discussing general aspects of tuberculosis and safety measures to be observed in the laboratory, the manual gives detailed information on collection and shipment of specimens, laboratory methods of processing clinical materials, and cultural characteristics useful in identification of acid-fast bacilli. It also covers use of laboratory animals for typing of certain acid-fast bacilli, cytochemical procedures used for virulence testing and typing mycobacteria, and methods of testing sensitivity of tubercle bacilli to therapeutic agents.

An extensive bibliography of material available through July 1959 is included.

Highlights of Research Progress in General Medical Sciences, 1959. *PHS Publication No. 739; 1960; 23 pages; 15 cents.*

Twenty-seven examples of research studies supported by the National Institutes of Health, Public Health Service, are reported in this pamphlet.

Included are findings in chemistry of life processes; genetics, cell biology, and human development; clinical research; and research in public and environmental health.

Costs of Operating Nursing Homes and Related Facilities. An annotated bibliography. *PHS Publication No. 754; 1960; by Maurice E. Odoroff, Anna Mae Baney, and Anne B. Stageman; 38 pages; 20 cents.*

References to information on the costs of providing care in nursing homes, nonprofit homes for the aged, public facilities, and boarding homes are listed. A summary table highlights the general range in costs among facilities in these four categories. Additional references deal with accounting records for nursing homes and related facilities.

This bibliography should be useful to administrators of these facilities, State agencies responsible for planning, constructing, and licensing nursing homes, public assistance agencies, and persons concerned with the costs of providing care for the aged.

Homemaker Services in the United States. Report of the 1959 National Conference on Homemaker Services. *PHS Publication No. 746; 1960; 257 pages; $1.25.*

Thirty-seven conclusions and recommendations provide the framework of this report.

An account of the development of homemaker services, description of present-day organizations and

services, and discussion of the need for expanding and adapting services under several types of auspices are included. The report also provides practical advice for organizing, administering, and financing homemaker services.

An annotated bibliography contains some 100 titles, most of them with publication dates since 1950.

Federal Programs for Collection of Data on Water Use. *Notes on Hydrolic Activities Bulletin No. 10; 1960; 43 pages; 35 cents.*

Federal agencies collecting data, collection schedules, scope and availability of data, and miscellaneous details are listed by category of water use. Categories include rural domestic, public water supplies, agriculture, manufacturing and mineral industries, hydro and thermo power, pollution abatement, recreation, fish and wildlife, and Federal installations.

This bulletin was produced as part of a program to determine the extent of data collection and the unmet needs for data. It was prepared under the auspices of the Inter-Agency Committee on Water Resources, Subcommittee on Hydrology.

Insects That Carry Disease. *PHS Publication No. 594 (Health Information Series No. 90); revised 1960; leaflet; 10 cents, $5 per 100.* Describes habits and habitats of flies, cockroaches, mosquitoes, fleas, and ticks. Gives effective insecticides and repellents. Suggests sanitation practices for reducing infestations.

Water Supply and Pollution Control. Research inventory, active projects, 1958. *PHS Publication No. 768; 1960; 71 pages.*

Designed to facilitate exchange of information among research personnel, this inventory lists 280 projects by State. Site and title of each project as well as source and amount of financial support are given.

A subject index to the projects is included. Names and addresses of those who reported the data provide a source for more detailed information.

Notable Contributions to Medical Research by Public Health Service Scientists. A biobibliography to 1940. *PHS Publication No. 752; 1960; by Jeanette Barry; 96 pages; 60 cents.*

Brief biobibliographies present a selection of books and articles by and about medical and scientific officers of the Public Health Service, most of whom worked in the Hygienic Laboratory (later the National Institutes of Health) and in the Division of Scientific Research. They are collections of "landmarks" and are not intended to summarize the entire contribution of the Public Health Service to medical research during the period covered. The works included have been consistently cited in bibliographies as classic or original studies in their respective fields.

A chronological table lists the scientists and their fields of research.

Public Health Service Film Catalog. *PHS Publication No. 776; 1960; 66 pages; 50 cents.*

Some 320 motion pictures and filmstrips are listed by subject, with description, suggested audience, and information concerning availability for purchase. Titles are also given in alphabetical order and a subject index is included.

While the majority of these films are designed for training in the health professions, a number are intended for use with specific lay groups or with the general public.

All films included were produced by, for, or in cooperation with the Public Health Service, and they are available on loan from the film library of the Communicable Disease Center in Atlanta, Ga.

Infectious Diseases in the Aging. *PHS Publication No. 762; 1960; 238 pages; $1.50.*

Designed to provide a reference source on diagnosis, care, and treatment of infectious diseases in older persons, this volume consists of reprints and abstracts of pertinent articles together with a list of selected readings.

The materials are grouped into a general category and under diseases of five organ systems: respiratory, skin and special sensory organs, cardiovascular, gastrointestinal, and genitourinary.

Compilation of these materials was stimulated by the forthcoming White House Conference on Aging. The book is intended for use by public health agencies, medical care personnel, and others interested in the overall health needs of an aging population.

Diphtheria. *PHS Publication No. 60 (Health Information Series No. 37); revised 1960; leaflet; 5 cents, $2.50 per 100.* Describes symptoms and methods of spreading diphtheria. Urges immunization of babies at 2 or 3 months of age and a "booster shot" about every 3 years. Recommends that persons previously immunized have "booster shot" at once if exposed to diphtheria.

Typhoid Fever. *PHS Publication No. 282 (Health Information Series No. 72); revised 1960; leaflet; 5 cents, $2 per 100.* Describes symptoms and manner of spreading typhoid. Advocates good community and home health practices, including maintenance of safe water supply, proper sewage disposal, and pasteurization of milk. Recommends vaccination before vacationing or traveling in rural areas.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.

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